AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
THE AMERICAN ASSOCIATION OF ORTHODONTISTS,
ITS COMPONENT SOCIETIES, AND
THE AMERICAN BOARD OF ORTHODONTICS

PUBLISHED BY THE C. V. MOSBY COMPANY, ST. LOUIS 3, U. S. A.

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Vol. 42, No. 9, September, 1956. American Journal of Orthodontics is published monthly by The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo. Subscription rates: United States and its Possessions $10.00, Students $5.00; Canada, Latin-America, and Spain $10.50, Students $5.50; Other Countries $11.00, Students $6.00. Single copies $1.75 postpaid. Entered as Second-class matter, January 14, 1915, at the Post Office at St. Louis, Missouri, under the Act of March 3, 1879. Printed in the U. S. A.

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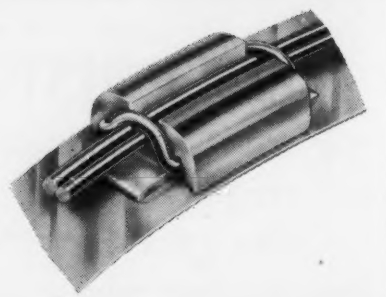

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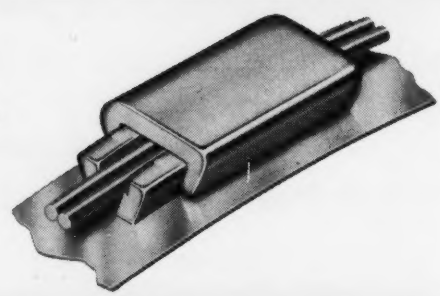

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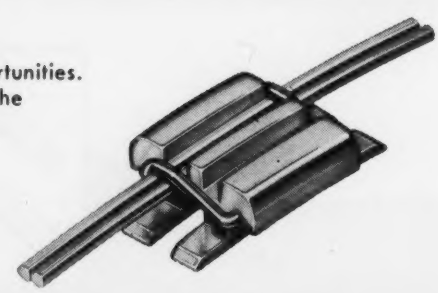

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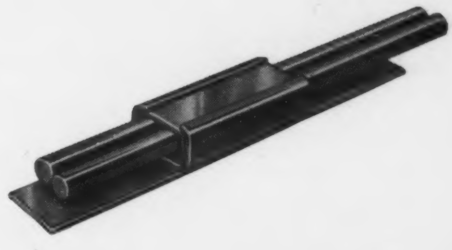

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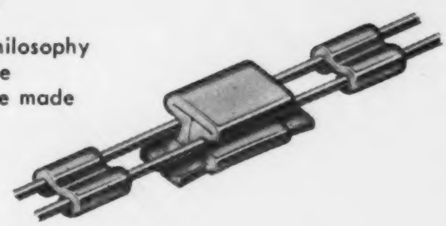

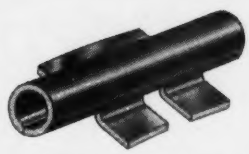

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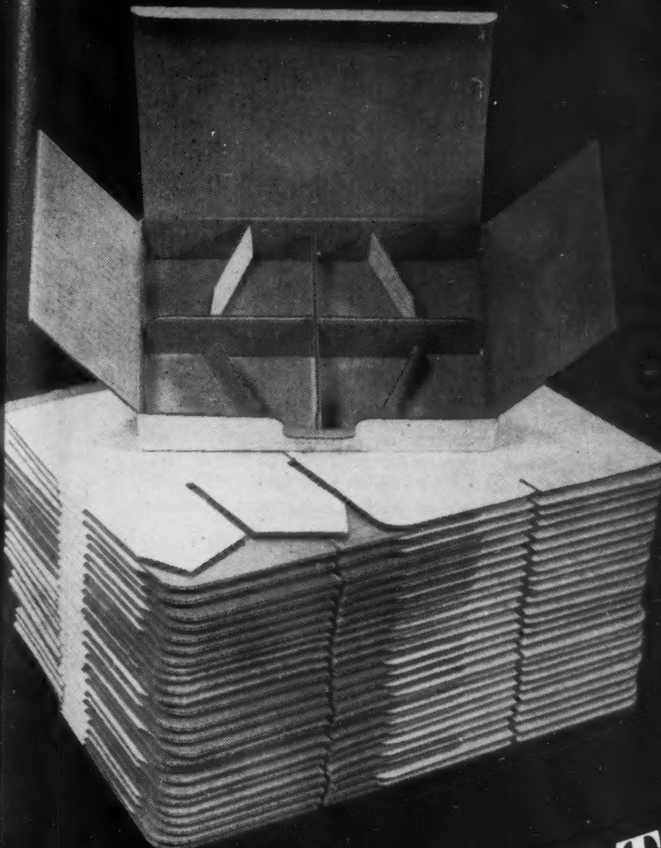

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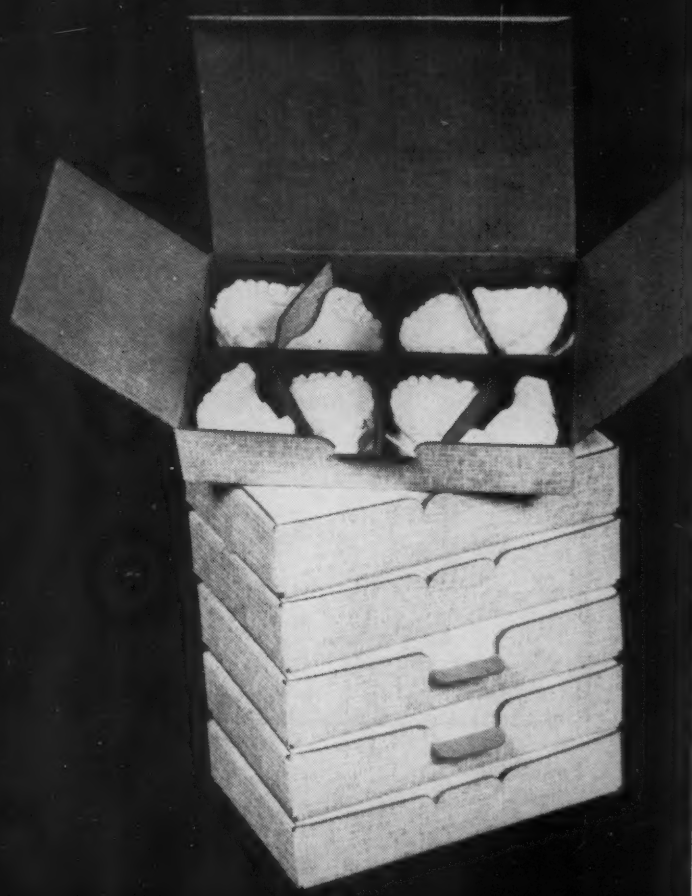

American Journal *of* ORTHODONTICS

VOL. 42 SEPTEMBER, 1956 NO. 9

Original Articles

ADDRESS OF WELCOME

ROY O. GREEP, PH.D.,* BOSTON, MASS.

I AM pleased and honored to welcome you to Boston. The odds against having this opportunity are statistically so strong that I can call it the privilege of a lifetime, without the slightest risk of seeming trite. It figures out this way: According to my calculations, you last met in Boston forty-five years ago.** On a rotating basis between the two dental school deans in Boston, it is therefore predictable that, unless things change, this is an opportunity that would come to the Harvard dean once every ninety years. This, in itself, is an unhappy prospect, but the disturbing implication is that this infrequency of meeting in Boston raises sinister doubts as to whether Boston is, in fact, the Hub of the Universe.

You will sense that I have been peering into the history of your Association. I found this both interesting and instructive. The pity is that you will immediately perceive that I was in search of a frame of reference for these welcoming remarks. Having a frame of reference has, indeed, become the universal hallmark of the speaking trade. Whence:

Show me a dean with tongue so glib
As to frame his reference in *words ad lib!*

Although the history of this Association spans but a brief fifty-odd years, your roster boasts a notable number of distinguished men. I am impressed not

Read at the fifty-second annual meeting of the American Association of Orthodontists, Boston, Massachusetts, April 30, 1956.

*Dean of Harvard School of Dental Medicine.

**Alfred Rogers was president at that time.

alone by those whose pioneering studies and procedures erected the specialty of orthodontics, but also by those whose eminence rests on their broad contributions to science and education. Above all, however, you can take unbounded pride in having produced some great thinkers. These men helped to endow dentistry with the intangible attributes that make it a profession; they gave to dentistry an ennobling philosophy. This is the moral and spiritual basis of the ethics and idealism of dentistry. By reason of it, dentists strive unceasingly to attain excellence in all that they do. It is, in fact, for no lesser motive that you continue to assemble for these annual meetings.

Just as in every other health profession, the impact of new knowledge and the certainty of continuing scientific progress are changing the face of orthodontics and of dentistry. If I read the signs and trends correctly, dentistry is about to enter an era of unprecedented development. There is everywhere evidence of the awakening of a public consciousness of the importance of dental health service. That total health care cannot be attained by disregarding oral health is gaining the acceptance that the fact warrants. These developments will advance dentistry on a broad front, and attract the able students to it. However, these good things will not just accrue. Great opportunities pose equal challenges. Vigorous, informed, and united effort, as well as intelligent leadership, will be needed to attain these objectives.

It will interest, but not surprise, you to know that at Harvard University instruction in orthodontics is regarded as an essential component of undergraduate dental education. Orthodontics has a fair representation in our curriculum. Our graduates are instructed in the fundamentals of orthodontics and have a clinical experience covering two full academic years in treating the simpler variety of orthodontic cases. There is no doubt whatever that instruction in orthodontics both enlivens and enriches the undergraduate curriculum. In competing for student interest, orthodontics often fares perturbingly well. Here I would remark only that interest in the subject and motivation for learning are inseparable. Two of your members played important roles in establishing the Harvard School of Dental Medicine. To them I owe a debt of gratitude for having introduced me to the fascinations of dentistry through the medium of their orthodontic researches and their interest in dental education.

In the annals of dentistry, Boston has been the setting for items of historic note. First, there was Paul Revere, the dentist who, on April 18, 1775, at the signal of "one if by land and two if by sea," rode furiously through the night in the interests of national defense.* Then, about 100 years ago, Boston was the site of the origin of dental jurisprudence. John Webster, as the story goes, was professor of chemistry and mineralogy at Harvard, with quarters in the school's anatomy building. The professor's wife and daughters were wont to live beyond his means. He borrowed not once, but thrice from his friend, Dr. George Parkman. Webster defaulted on the debt, and Dr. Parkman took

*These parts nurtured many other distinguished dentists who contributed abundantly to the profession. It may be fitting to mention Henry Albert Baker who introduced the "Baker anchorage," the reciprocal elastic force so universally used in orthodontics. It is reported that he first used it in the retraction of incisors on his son, Lawrence, who later became a professor of orthodontics at Harvard.

to hounding him in such ways as turning up in the front row at Professor Webster's lectures. Professor Webster's solution to this perplexing situation entailed a busy week end in the furnace room at the anatomy building, and all would have gone well except that Dr. Parkman's dentures turned up in the ashes and were identified in court by his dentist, Dr. Nathan Cooley Keep, who was Harvard's first dental dean. Few other Harvard professors have caught the public fancy in quite the enduring fashion that Dr. Webster did. However, the facts of history fade with time and nowadays the roles that these two men played are often reversed in the telling.

In 1867 the first university dental school in the United States was established at Harvard University. I need not relate for you its contributions. The school was reorganized in 1941 to provide an even greater emphasis on training in the sciences basic to health and disease. The students, of necessity, are highly selected. The educational program provides the same preparation in fundamental human biology that is given to candidates for practice in any other health service. That this has been done without impairment of their preparation in the techniques of dentistry is now determinable. The school is open and would welcome inspection at your pleasure.

I have enjoyed meeting with you, and I take this opportunity to wish you a rewarding and gratifying meeting.

RESPONSE TO ADDRESS OF WELCOME

A. C. BROUSSARD,* NEW ORLEANS, LA.

I AM somewhat embarrassed this morning. I am so accustomed to listening to addresses of welcome from mayors or city fathers that I am somewhat at a loss to know what to say to you after you have just listened to this interesting address of welcome from an educator, particularly one coming from the place and affiliated with the university which for so long has been the Mecca of learning in the United States.

Meeting in this city, which is so full of traditions, is something that we will not soon forget. Boston, from an historical standpoint and from a literary point of view, is full of cultural traditions that cannot be matched elsewhere in these United States. A lot of things have originated in Boston that the histories of very few cities can parallel. Politically, it has had a great impact upon the course of events in this land of ours, but I will not dwell upon that now. Culturally, it was the birthplace of at least two of our great literary giants—Ralph Waldo Emerson and Oliver Wendell Holmes. Scientifically, it can boast that Benjamin Franklin was born here, although another city has claimed Franklin as its own. Boston also boasts that the first woman doctor practiced here. (However, she was hanged for the humanitarian deeds that she was doing!) Nevertheless, Boston produced many things that we can look to with admiration even today. Many historical figures lived here, although probably the one that most Americans know best is Paul Revere. Frankly, I do not know exactly what Paul Revere was by trade. I understand that, in addition to being a dentist, he was interested in a number of things. I have heard him referred to as an engraver, silversmith, an industrialist, and even as a horseback rider. However, we can be proud of the fact that he was also a dentist, and that the findings which he made are still being used today. I understand that he was the first dentist to identify an unknown person by his teeth; today this is something that is made use of everywhere in the world.

This is a fitting occasion to pay tribute again to the late Dr. Henry Baker, a Boston pioneer in orthodontics, who gave us the Baker anchorage (now called "intermaxillary" anchorage), a method universally used. I wonder what orthodontics would be today without the Baker anchorage!

Boston also is full of traditions from the educational standpoint, with the Harvard School of Dental Medicine being the first university-affiliated dental school in the United States. Baltimore had the first dental college, but Harvard has produced many things, from a dental and educational point of view, which we should cherish.

Dr. Greep, on behalf of this Association, we thank you for that very heartening address of welcome.

*President-Elect of the American Association of Orthodontists.

A STUDY IN THE DEVELOPMENT OF AN ELECTRONIC TECHNIQUE TO MEASURE THE FORCES EXERTED ON THE DENTITION BY THE PERIORAL AND LINGUAL MUSCULATURE

ROBERT V. WINDERS, D.D.S., M.S.D., CHICAGO, ILL.

THIS research was a study in the development of an electronic technique for measuring the forces exerted on the dentition by the lips, cheeks, and tongue. It represents an attempt to initiate research in a field which has been left far too long to clinical evaluation.

The advantages of numerical expression has been aptly phrased by Lord Kelvin:

> I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it, but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be.

This scientific approach has been well exemplified by the significant advances made in the field of growth and development utilizing cephalometric radiography.

Our thinking must be constantly re-evaluated in the light of new information. So it is with the concepts regarding occlusion of the dental arches. No longer can the subject be approached solely from a static aspect; rather, it must be viewed as a dynamic functioning unit, having an effect on, and being influenced by, the body as a whole.[1] This body system is comprised of many anatomic and physiologic features, each of which adds its share to the efficiency of the whole system.

Of the various components involved, the effects of the musculature on the dentition are more difficult to evaluate than the rest. This undoubtedly is a consequence of the inability to adapt an exacting analytic method of measuring cause and effect.

Over the years, the significance of the perioral and lingual musculature in the positioning of the teeth has been pointed out many times, first by Wallace[2] in 1904, and later by Rogers,[3] Swinehart,[4] Gwynne-Evans,[5] and Strang,[6] among others.

Read at the fifty-second annual meeting of the American Association of Orthodontists, Boston, Massachusetts, May, 1956.

Awarded first prize in the 1956 Annual Prize Essay Contest of the American Association of Orthodontists.

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Dentistry, Northwestern University, 1955.

The generally accepted concept postulates that the teeth find a position of equilibrium in which the sum of the forces tending to move them in one direction equals the sum of those forces tending to move them in the opposite direction.

Research investigators of the past have interested themselves primarily in the measurement of biting forces. Many instruments designed for the measurement of these forces are described in the literature. One of the more recent ones was developed in 1948, when Howell and Manley[7] adapted an electronic transducer for the measurement of maximum biting forces. This method employed the principle of the strain gauge, utilizing an inductance coil.

More recently, researchers have become interested in the forces exerted by the tongue, cheeks, and lips on the dentition. This interest has been somewhat dependent on the coincident with the development of suitable methods and instrumentation with which to measure these forces.

In 1950, Feldstein[8] described an instrument consisting of a small pressure capsule which was placed in the mouth and connected to a manometer system by means of a small plastic tube. A preliminary conclusion drawn from this investigation was that, in evaluating twenty-five cases of normal occlusion, the force exerted by the cheeks on the buccal surface of the upper right first molar was approximately 3.5 grams.

The next attempt at designing a suitable instrument for the measurement of these muscular forces was made in 1953 by Alderisio,[9] who utilized the principle of the resistance strain gauge as the transducer element. He did not, however, calibrate his instrument in terms of numerical weights, but rather was interested primarily in a graphic presentation of the dynamics involved in the muscle actions.

Two years ago, Margolis and Prakash[10] described a new instrument which they called the *photoelectric myodynagraph.* It consisted of a compressible rubber capsule which was placed in the mouth and which received the muscular pressures. These pressures were transmitted by way of small rubber tubing to a photoelectric recording unit. Two pressure capsules are used with this instrument—one designed to measure from 2 to 750 grams, and the second to measure from 5 to 2,000 grams. Calibration charts show the degree of error for this instrument to be from 5 to 6 per cent.

In a study designed to evaluate the effect of myofunctional exercises on the oral muscles, the following preliminary evaluations were made: "An increase in muscle forces of 29 per cent (upper lip) to 27 per cent (lower lip)."[11]

Another apparatus, used by White and Sackler[12] to study the effects of progressive muscular dystrophy on the dentition, resembled Feldstein's. It consisted of a pressure capsule attached to a manometer system. White and Sackler admitted that, although the instrument was designed to measure relaxed normal pressures, the results were so variable that they were put aside to await development of a proper technique for this measurement. They

concluded that the spacing and enlargement of the dental arches were due to the difference in degeneration between the perioral and lingual musculatures, with the tongue being slower in its dystrophic process.

Electronic methods have been applied to various investigations in recent years. Manly, Yurkstas, and Reswick[13] adapted an electronic technique for the measurement of tooth mobility in 1950.

In 1951, Brudevold[14] adapted an electronic technique for the measurement of chewing forces on the teeth of a denture wearer using zero-degree-cusp posterior teeth.

Within the last year, Stromberg[15] adapted the (SR4) strain gauge in measuring the amount of pressure on the tissues of a patient wearing dentures.

One of the major advances in research on muscle physiology has occurred in recent years with the development of electromyography, an electronic technique which again exemplifies scientific progress in instrumentation. From this research, much valuable information in basic physiology is being obtained.

A review of the literature would indicate that the trend in orthodontic thinking is toward a more comprehensive appraisal of the various factors which influence the "stomatognathic system." It further indicates the increasing importance of the musculature in this system.

It therefore becomes imperative that suitable methods and instrumentation be devised and refined to initiate research in this important facet of physiology.

To this end, it was the purpose of this study to develop an electronic technique to measure these muscle pressures, to survey the ranges of some of the various pressures acting on the dentition, and to do this in such a manner as to establish the reliability of the method.

METHODS AND MATERIALS

The requirements of such an instrument are:

1. It must record accurately a large range of pressures.
2. The mouthpiece must be small, comfortable to the patient, and easy to apply.
3. The instrument should be simple to operate.

The use of metal, as opposed to a rubber capsule, for the elastic unit to which the intraoral pressures may be applied has certain advantages. For example, the stress-strain curve of metal is more reliable and linear in nature than that of rubber. The elastic qualities of metal are affected less than rubber by a rise in temperature due to placement in the mouth. Also, the amount of fatigue encountered over many months of use probably would be less in metal. Consequently, in considering these advantages, it is logical to assume that a smaller unit could be constructed to be placed in the mouth and still retain the desirable physical properties. This, in turn, might yield more accurate data.

In considering a metal as the elastic unit for such an instrument, it is well to understand certain basic principles of the measurement of strain. If a metal is subjected to bending, a strain is induced. If a beam of metal is being con-

sidered, the strain on the top surface is termed a *tensile* strain and that on the under surface a *compressive* strain, with the greatest strain occurring at a moment nearest the fixed or supported end.

The method used in this investigation for the measurement of strain utilized the SR4 resistance strain gauge. This type of strain gauge depends for its operation on the fact that the electrical resistance of a metallic wire changes as it is subjected to strain. This phenomenon was discovered by Lord Kelvin. He found that if a wire is stretched, its resistance will increase; if it is placed under longitudinal compression, its resistance will decrease. The usual form for the resistance strain gauge consists of resistance wire wound back and forth

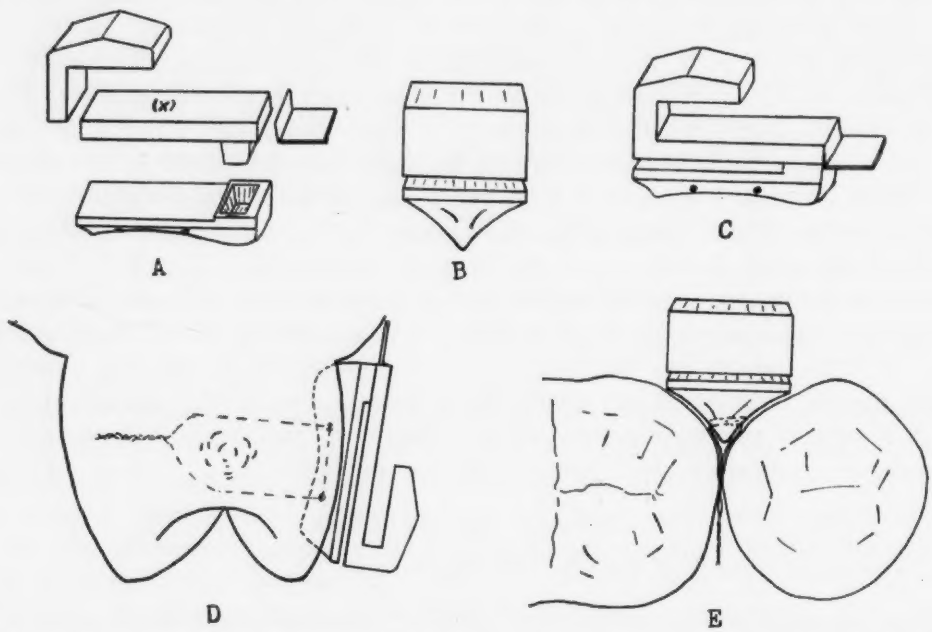

Fig. 1.—*A*, *B*, and *C*, Design of gauge carrier; *D* and *E*, mode of attachment to teeth; *X*, active beam.

in the form of a grid which is cemented between two pieces of thin paper. This gauge is bonded securely with cement to the member to be strained, so that any strain in the member is transmitted to the wire. Consequently, any strain in the member is measured by measuring the change in resistance of the wire, and results in a linear function. This method of measuring strain is fairly simple and has a high degree of accuracy, with repeated measurements showing as little as 0.1 per cent error.

The gauge carrier (Fig. 1), which contains the elastic unit to which the strain gauges are attached, was constructed in type "C" inlay gold. It was first fabricated in wax and then cast, using the usual lost-wax casting procedure. This allowed considerable freedom of design and the elastic qualities of gold are very acceptable.

The gauge carrier was cast in four parts, as shown. The active beam was 4 mm. long, 3.5 mm. wide, and 0.65 mm. thick. These dimensions were adequate

to accommodate the smallest strain gauge available and were computed mathematically to function within the elastic limits of the material. The gauge carrier was assembled with the parts soldered together and then cemented to the backing. The mode of attachment to the teeth is shown.

Although most of the technical problems were solved by using a larger strain gauge, the type of gauge which was used for this investigation was the A19, SR4 strain gauge with a resistance of 60 ohms and a gauge factor of 1.7. These strain gauges are manufactured by the Baldwin-Lima-Hamilton Corporation of Philadelphia, Pennsylvania, and are composed of Constantan wire.

Since resistance strain gauges are very delicate and sensitive, it was necessary to modify the strain gauge in such a manner as to prevent movement in the lead wires of the strain gauge. This was done by trimming the excess paper

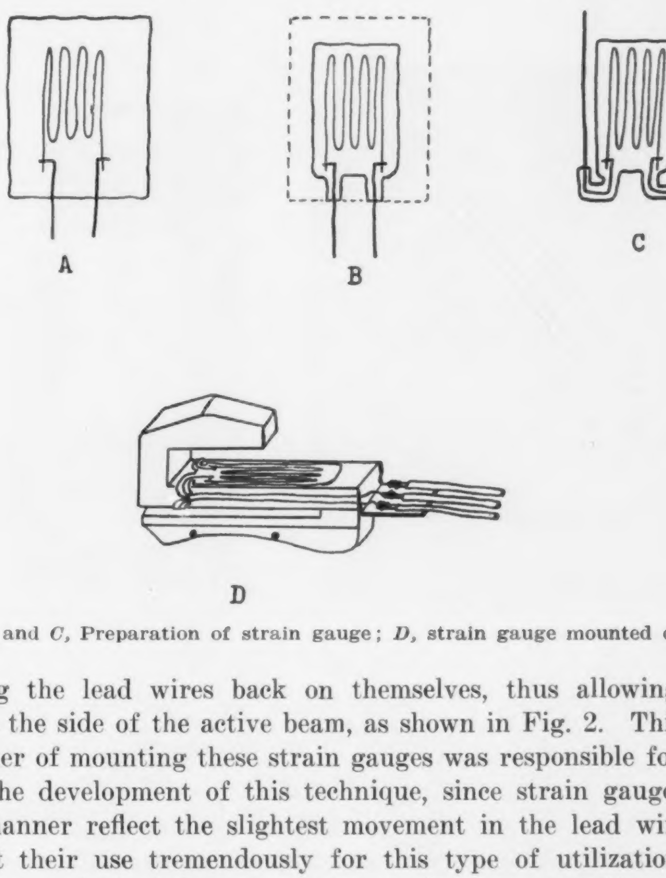

Fig. 2.—*A*, *B*, and *C*, Preparation of strain gauge; *D*, strain gauge mounted on gauge carrier.

and bending the lead wires back on themselves, thus allowing them to be cemented to the side of the active beam, as shown in Fig. 2. This modification in the manner of mounting these strain gauges was responsible for much of the success in the development of this technique, since strain gauges mounted in the usual manner reflect the slightest movement in the lead wires and therefore restrict their use tremendously for this type of utilization. There are other advantages derived from mounting strain gauges in this manner and by utilizing the principle of a free-ended cantilever beam as the elastic unit. One advantage is that the grid of the strain gauge may be placed closer to the fixed end of the active beam, thus registering a greater amount of strain. By utilizing the principle of a free-ended elastic beam, two gauges may be employed; this not only allows for mutual temperature compensation, but also doubles the sensitivity.

The gauges, together with the lead wires, are firmly affixed to the gauge carrier in the manner shown and very small, multistranded, silver connecting wires are soldered to the lead wires and mounted on the platform. With care being taken that the connections and wires do not come in contact with the gauge carrier, the strain gauges are then insulated against moisture from the mouth. A suitable brush-on polyvinyl plastic material was found to be acceptable for this purpose.

The instrument was then calibrated, using a simple calibrating apparatus by which the amount of pressure or load (in grams) could be interpreted in number of lines deflection of the oscillograph needle in the recording apparatus.

The method employed the principle of the second-class levers, in which a load applied at the center of a beam supported at both ends is equally distributed at both ends.

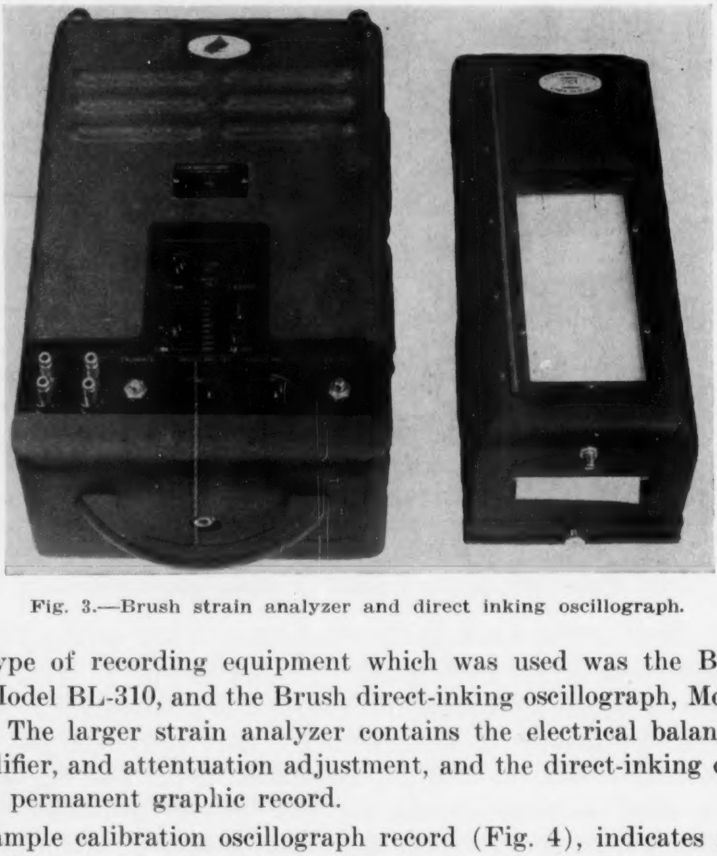

Fig. 3.—Brush strain analyzer and direct inking oscillograph.

The type of recording equipment which was used was the Brush strain analyzer, Model BL-310, and the Brush direct-inking oscillograph, Model BL-202 (Fig. 3). The larger strain analyzer contains the electrical balancing equipment, amplifier, and attentuation adjustment, and the direct-inking oscillograph produces a permanent graphic record.

The sample calibration oscillograph record (Fig. 4), indicates a deflection of the needle above the base line, which is a linear function with regard to pressure versus deflection. The peaks which extend below the base line represent the stopping and starting of the oscillograph. The arrow indicates the direction of the paper and, although there are three speeds available (5, 25, and 125 mm. per second), only the slowest speed was used throughout the investigation.

Calibration experiments were completed before and after the collection of the data, and regression coefficients were computed. Upon comparison of the original and final calibrations, there was only a very small error introduced over five months of use. The strain analyzer incorporates an attenuation adjustment by which the operator can select the range of sensitivity which is desired. It can be desensitized by one-half, one-fifth, and so on, depending on the amount of deflection of the oscillograph needle which the range of pressures demands.

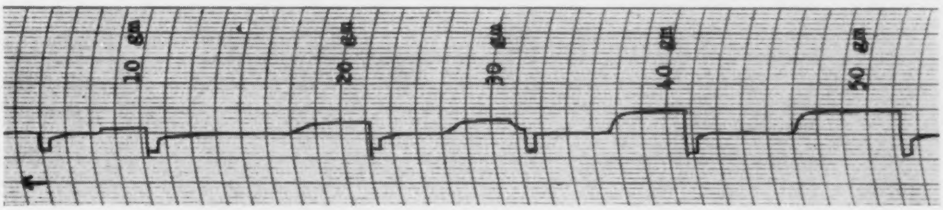

Fig. 4.—Sample calibration oscillograph record. (Arrow indicates direction of paper.)

In an effort to investigate some of the muscular pressures which were active on the dentition, five areas of the mouth were selected for survey. Seven subjects with excellent occlusion (appraised not only clinically, but also cephalometrically) were investigated. Records were obtained in each of the five areas during rest and four functional exercises. In an effort to establish the reliability of the technique, each exercise was repeated three times; after the series of exercises had been completed, the mouthpiece was replaced in the same area and the entire series was again repeated.

RESULTS

At the beginning of each recording, the instrument was first calibrated without contact with the tissues, so that the first registration was a record of resting pressure; after the initial registration, it became the base line to which the oscillograph needle returns.

A swallowing exercise, which consisted of having the subject swallow on command as casually as possible, was used. Two cubic centimeters of room-temperature water was first taken into the mouth to reinforce the supply of saliva in an effort to obtain a more normal swallowing reflex.

Sample oscillograph records (Fig. 5) are shown for various areas. The vertical arrows indicate the actual time of swallowing. This exercise consistently showed an increase of pressure in the molar area from the lingual musculature. The buccal musculature, however, did not exhibit this increase of pressure.

A sucking type of exercise, which consisted of drinking 40 c.c. of water through a straw, was introduced. This exercise does not, however, simulate the response which might be elicited from thumb-sucking, where considerable re-

sistance would be expected. Although a greater force was exerted on the dentition by the lingual musculature during this exercise, it was demonstrated that a distinct increase in pressure on the buccal surfaces of the lateral segments can occur as a result of thumb-sucking.

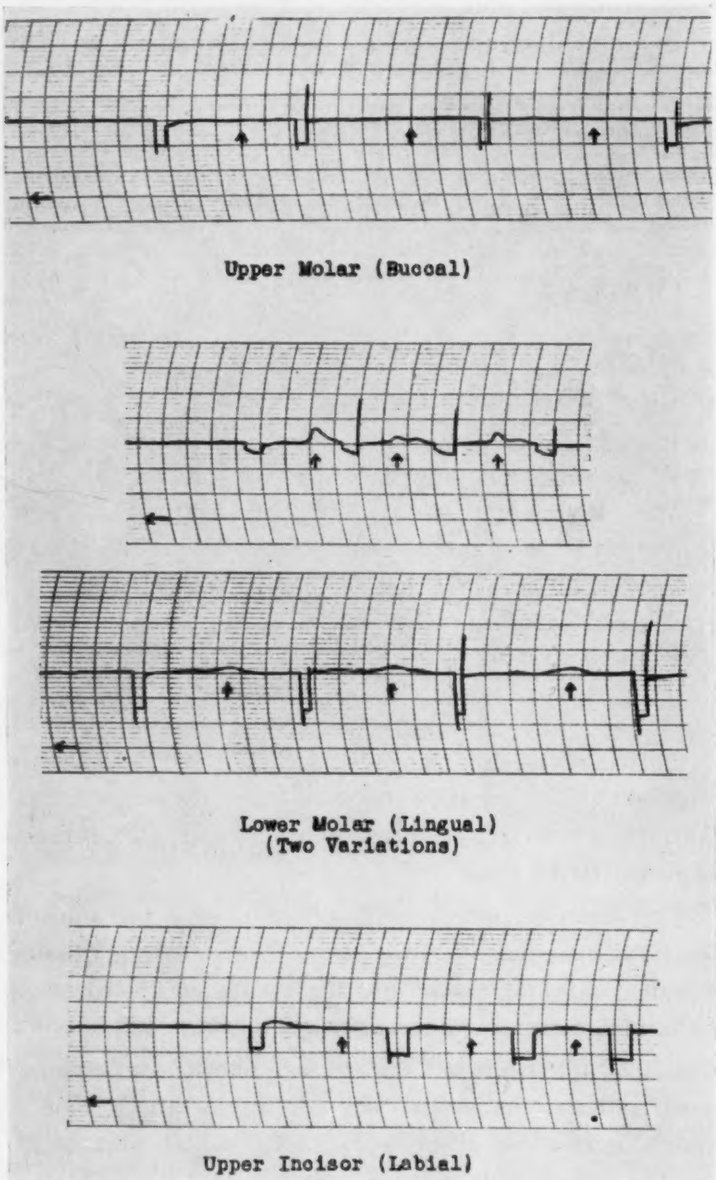

Fig. 5.—Oscillograph records (swallowing exercise). (Vertical arrows indicate time of swallowing.)

An exercise which consisted of having the subject repeat a standard sentence in a normal conversational tone was also introduced. It was noted that

there was a consistency to the pattern of the records, with the greatest changes of pressures occurring on the lingual and labial surfaces and with very little change noted on the buccal surfaces.

A maximum effort was obtained by having the subject exert as much pressure as possible against the mouthpiece in each of the areas surveyed. Fig. 6

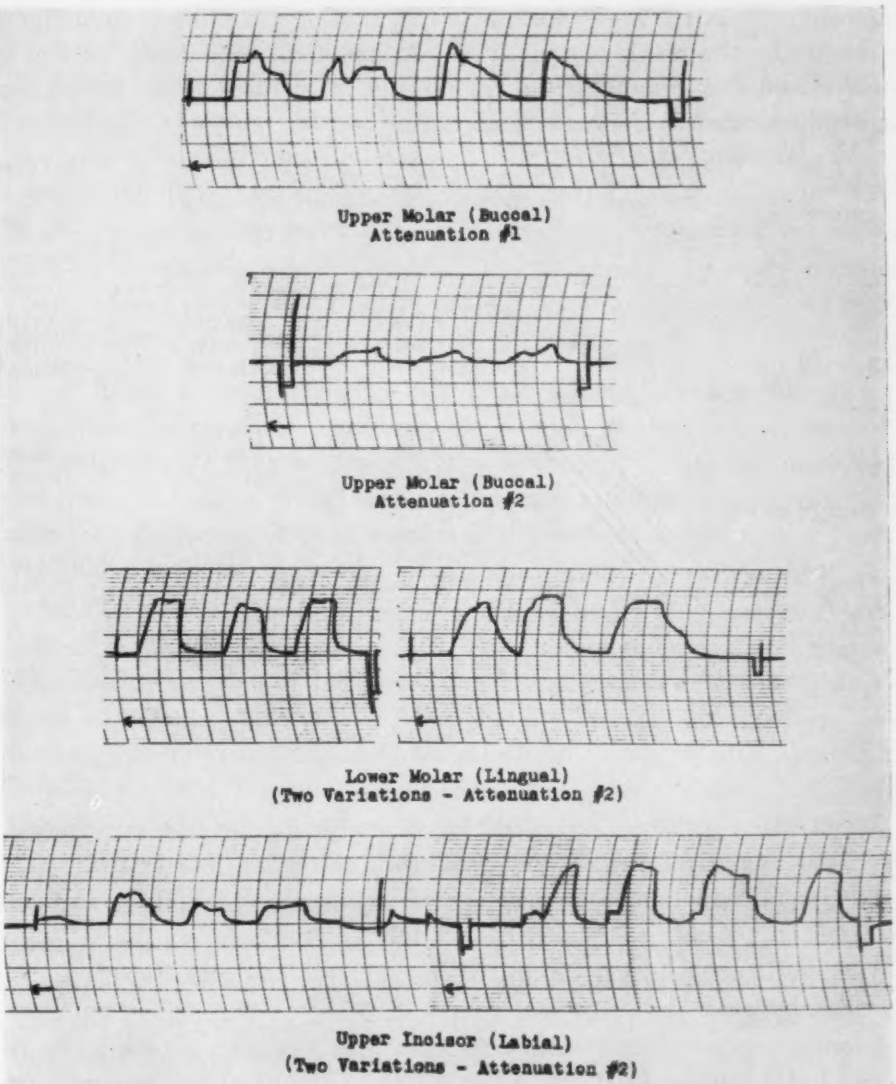

Fig. 6.—Oscillograph records (maximum effort exercise).

represents sample oscillograph records for various areas, with each peak representing a separate contraction of the musculature, and demonstrates the usual short initial contraction time and a prolonged relaxation time.

The first two sample records, which were obtained in the same area of the mouth, show the effect of the attenuation adjustment of the strain analyzer.

Although the pressures are approximately the same in the first and second records, the deflection of the needle may be governed according to the amount of deflection desired. Again, as we compare the relative pressures produced during this exercise, we find that the tongue is capable of exhibiting a greater pressure than is the buccal and labial musculature. It was found that the tip of the tongue could exhibit as high as 600 to 800 grams of pressure on the lingual surfaces of the lower anterior teeth, as compared to less than 200 grams of pressure by the cheek musculature. A statistical comparison of the buccal pressures and the lingual pressures on the lateral segments during various functional exercises is shown in Table I.

TABLE I. ANALYSIS OF VARIANCE
(COMPARISON OF LOCATIONS — VARIOUS EXERCISES)

SOURCE OF ERROR	DEGREE OF FREEDOM	SUM SQUARES	MEAN SQUARES	"F" RATIO
(Swallow)				
A-B	1	16.298	16.298	0.149
C-D	1	11.441	11.441	0.105
(AB) - (CD)	1	16,800.000	16,800.000	154.456*
(Sentence)				
A-B	1	0.011	0.011	0.000
C-D	1	394.333	394.333	3.507
(AB) - (CD)	1	4,474.578	4,474.578	39.804*
(Maximum effort)				
A-B	1	10.716	10.716	0.000
C-D	1	2,702.680	2,702.680	0.159
(AB) - (CD)	1	794,750.150	794,750.150	46.941*

* = $P < 0.01$.
Locations:
A = Buccal—upper right first molar.
B = Buccal—upper left first molar.
C = Lingual—lower right first molar.
D = Lingual—Lower left first molar.

DISCUSSION

When the oscillograph records were analyzed and the amplitudes converted into numerical values, the data were subjected to statistical analysis. The results indicated that the instrument produced repeatedly consistent records, taken in not only succession but at different times.

The excellent occlusion group did not exhibit any statistically significant differences between the subjects.

However, a very significant difference was revealed between the results obtained in the various locations in the mouth. This point was analyzed further and it was shown that there was no significant difference between the results obtained in bilateral areas. The variation occurred when buccal pressures were compared to lingual pressures, with the "F" ratios being significant at the 1 per cent level (Table I).

The swallowing pattern, for example, as shown in Fig. 5, is altogether consistent with the accepted concept regarding the normal swallowing reflex. After the teeth errupt into occlusion and form a lateral and anterior wall for the

oral cavity during the initial mandibular closure of the swallowing reflex, the buccal and labial musculature need not contract. This absence of perioral muscular contraction has also been borne out by electromyographic investigations. The numerical results indicated that the tongue exerted up to four times the pressure of the buccal musculature during the various functional exercises.

The implications of the above conclusion are far reaching. Sicher[16] has suggested that the perioral and lingual musculature does not exert much influence on the positioning of the teeth.

He further points out that the perioral and lingual musculatures are not truly antagonistic in their action, as are the flexors and extensors of the forearm, for example. They are not associated with a single joint, nor do they move a common part. Moreover, the tongue, being the stronger of the two muscle groups, is obviously capable of exerting more pressure on the dentition, particularly in a maximum effort exercise.

There remain only a few possible explanations for the apparent imbalance of muscular forces as shown from this investigation.

1. There is not the balance of the musculature between the buccal and lingual sides of the dentition; the position of the teeth is dictated primarily by the skeletal base; and only in extreme changes in pressures, as incurred in thumb-sucking, aglossia, macroglossia, progressive muscular dystrophy, muscle paralysis, etc., can a change in the position of the teeth be expected.

2. There is an equilibrium which exists within the dentition, and the sum of the forces which tend to move the teeth in one direction is equalized by the sum of the forces which tend to move them in the opposite direction. This statement could now be supplemented by assuming that there are other forces which will equalize this apparent imbalance of the musculature. These forces, for example, could be the forces of occlusion, the lingual inclination of the teeth, or the design of roots and their attachment to the alveolus.

At any rate, a statement that would imply a balance of muscular forces can be questioned in the light of the results of this investigation.

To appraise definitely the effect that muscular forces have on the dentition, and the degree of this effect, would be a problem which could be clarified only through extensive, well-coordinated investigations.

If reliable conclusions are to be drawn by using a method such as the one described in this investigation, some standardization of the technique must be accomplished. Due to the dearth of published data, it was impossible to compare the numerical results of this investigation with others which might be derived by using other methods. It is conceivable that different numerical results might be obtained with a variation in the size of the mouthpiece employed. This variation might occur not only as a result of increasing the sur-

face area of the mouthpiece, but it could be dependent somewhat on the degree to which it protrudes into the tissues of the mouth. Until such time as a standard technique evolves, the best approach will have to be the comparison of pressures by means of percentages and statistically by means of the analysis of variance.

CONCLUSIONS

1. A reliable and accurate method was devised for the measurement of the forces exerted on the dentition by the perioral and lingual musculature.

2. A technique was described for the utilization of resistance strain gauges in the construction of a transducer element.

3. An initial survey was completed of the forces acting on the dentition by the perioral and lingual musculature in various areas of the mouth during rest and function, on subjects with clinically excellent occlusion.

4. There is no apparent increase of pressure on the buccal surface of the maxillary first molar or the labial surface of the maxillary central incisors during the act of swallowing.

5. There is an increase of pressure on the lingual surface of the mandibular first molar during the act of swallowing.

6. There appears to be more pressure exerted on the dentition by the tongue than by the buccal musculature during speech.

7. The tongue is capable of exerting more pressure on the dentition during a maximum effort than the buccal musculature. The tip of the tongue is capable of exerting the most force, with the side of the tongue, upper lip, and cheek following in that order.

8. Certain exercises which apparently gave consistent results were described.

9. The results of this investigation indicate that there is an apparent imbalance of muscular forces acting on the dentition between the lingual and the buccal sides, with the greater force being exerted by the tongue.

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CLINICAL CONSIDERATION OF OCCLUSION

A Serial Study

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THIS presentation will consist of two parts: (1) a report of some observations pertinent to the understanding of occlusion and (2) an analysis of serial material from practice and research on nontreated and treated cases.†

In a group of eighteen children with good occlusion at the time of the completed permanent dentition, including the 2nd molars, sixteen had good occlusion in their corresponding deciduous dentition. However, in a group of twenty children with poor occlusion in their completed permanent dentition, a different picture was present. Of these twenty children, nine had Class I and eleven had Class II malocclusion. With respect to their deciduous dentition, six of this group had Class I, nine had Class II, and only five had good occlusion. These figures indicate that in many cases the type of occlusion is established early in life.

The following are two examples of poor occlusion which was present early in life.

Child S. D. had a Class II, Division 2 malocclusion (Fig. 1‡) which was basically maintained, as shown by her casts, from 2 years through 13 years of age.

Child E. R. had a Class II, Division 1 malocclusion (Fig. 2) at 2 years of age. This relationship was maintained until the age of 12 years 5 months, at which time active treatment was started. Records made at the completion of active treatment at 13½ years and the follow-up casts made at 15½ and 18 years show that a satisfactory result was achieved. It can be said with certainty that the Class II relationship was present at 2 years and earlier, that orthodontic treatment corrected the occlusion, and that the correction has stood the test of time.

Consideration of the records of a pair of identical twins provides some insight as to the interplay of genetic and nongenetic factors in occlusion. These twins were attested to be identical by blood tests performed by Dr. Philip Levine of Ortho Research Foundation. Dr. F. J. Kallmann of the New York

Read before the American Association of Orthodontists, Boston, Massachusetts, May 1, 1956.

Part of the data used is from the Department of Dentistry, Bellevue Hospital, and the Department of Obstetrics and Gynecology and the Department of Pediatrics of New York University College of Medicine.

*Associate visiting dentist, New York University-Bellevue Medical Center.

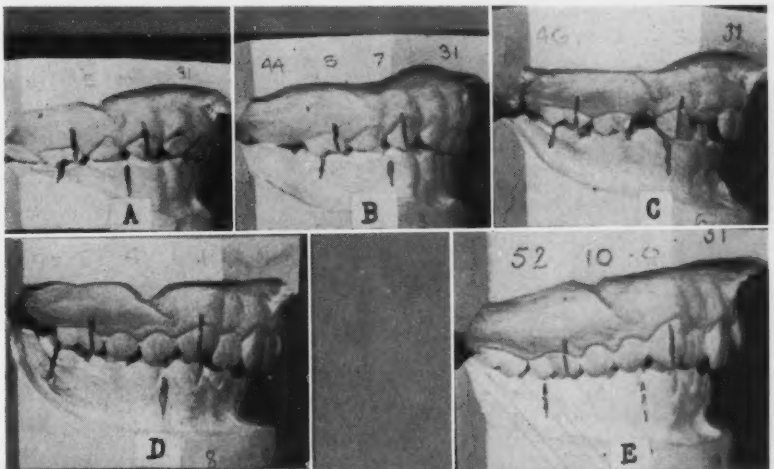
†All cases out of retention many years.

‡Only key casts are illustrated throughout.

State Psychiatric Institute examined them and studied their fingerprints. These children were then classified as ". . . monozygotic twins—difference in growth and handedness as well as deviations in occlusion."

Twin A. B. (first-born) had a normal delivery with low forceps. He was breast-fed for two months. His birth weight was 5 pounds, 1 ounce. At 1 year, he weighed 18 pounds; at 2 years, 24 pounds. He maintained a weight

Fig. 1.



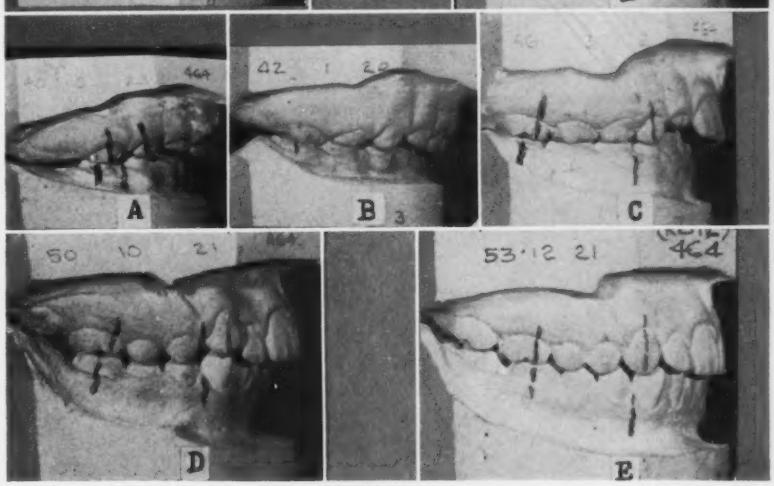


Fig. 2.

Fig. 1.—Right side view of child S. D. Note that the fundamental poor occlusion is maintained throughout the series. *A*, 2 years, 1 month; *B*, 5 years; *C*, 6 years, 8 months; *D*, 8 years, 11 months; *E*, 13 years, 5 months.

Fig. 2.—Right side view of child E. R. Note that the poor occlusion which was present when the first deciduous molar erupted was maintained to the age of 12 years, 5 months, at which time active treatment was started. The occlusion was corrected after twelve months of treatment, and the follow-up when the patient was 18 years of age showed the satisfactory result. *A*, 2 years; *B*, 3 years, 8 months; *C*, 7 years, 9 months; *D*, 12 years, 5 months; *E*, 15 years, 7 months.

and also a height advantage over the second twin throughout the series. He is right-handed. He had frequent colds and digestive upsets during his first two years of life. There were no observable habits that would affect the occlusion.

Fig. 3.—X-ray pictures of wrist shows that the carpal bones and epiphyses at 2 years, 5 months are more advanced for twin A. B., while at 10 years, 11 months they are the same. *A*, Twin A. B. at 2 years, 5 months; *B*, twin D. B. at 2 years, 5 months; *C*, twin A. B. at 10 years, 11 months; *D*, twin D. B. at 10 years, 11 months.

Twin D. B. (second-born) had a breech delivery. He received breast milk from a bottle for the first two months. His birth weight was 3 pounds, 4 ounces. At 1 year, he weighed 16 pounds; at 2 years, 22½ pounds. He is left-handed. The balance of his medical history was similar to that of his twin brother.

A bone age comparison of the twins from 2 years 5 months to 10 years 11 months revealed the following:

The wrist roentgenogram (Fig. 3) at 2 years 5 months showed child A. B. to be the more advanced twin in carpal bones and epiphyses. Later serial roentgenograms showed this advantage to have remained until 10 years 11 months, at which time the bone age of the twins was identical.

Concerning their dental age, the following information is of interest:

At 1 year 3 months, both twins (Figs. 4 and 5) had all incisors present. In addition, in twin A. B. the maxillary right first deciduous molar had partially erupted and the left first molar was just piercing the gum. The same degree of eruption was present in twin D. B., but on the reverse sides.

At 2 years 4 months twin A. B. had the maxillary *right* second deciduous molar, whereas twin D. B. had the maxillary *left* second deciduous molar. Since the first and second molars erupted on the right side in twin A. B. and on the left side in twin D. B., there is a suggestion that handedness and eruption may be associated.

At 2 years 4 months twin D. B. was advanced in dental age because other second deciduous molars had erupted.

At 5½ years, twin A. B. had erupted the maxillary first permanent molars, with the right molar more advanced. No permanent teeth had erupted in twin D. B. At 6 years 3 months, twin A. B. maintained his advantage in dental age by having all the first molars, whereas D. B.'s mandibular right first molar had not yet erupted.

At 7 years 2 months, twin A. B. retained the maxillary right lateral incisor and had shed the left lateral incisor. Twin D. B. had the same pattern of retention and shedding of the lateral incisors, but in the reverse order. Here again is a suggestion of a physiologic association with handedness.

A. B. maintained his dental age advantage to the age of 9½ years, at which time the twins had the same dental age. However, at 10 years 11 months, twin A. B. took the lead again. In the maxilla, he was advanced in the eruption of the canines and the right second permanent molar. Thus, in the permanent dentition A. B. had an advanced dental age, whereas in the deciduous dentition D. B. was more advanced.

The general arch form of both twins was similar. However, their occlusions were different. The vertical and horizontal overbite and the anteroposterior relationship throughout the series were greater for twin A. B. than for twin D. B., as shown (Fig. 6) in the lateral cephalograms taken at 7 years 2 months. Twin A. B.'s dimensions were significantly larger. Thus, the advantages of weight, height, method of early feeding, and physiologic age of the first-born twin (A. B.) were not reflected in a better occlusion.

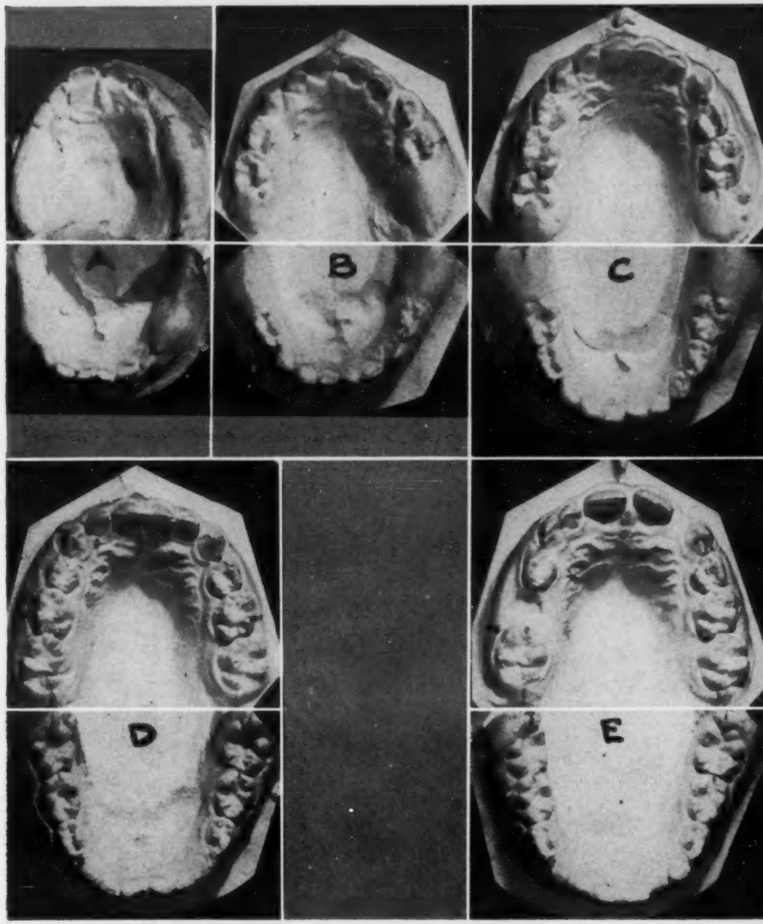


Fig. 4.

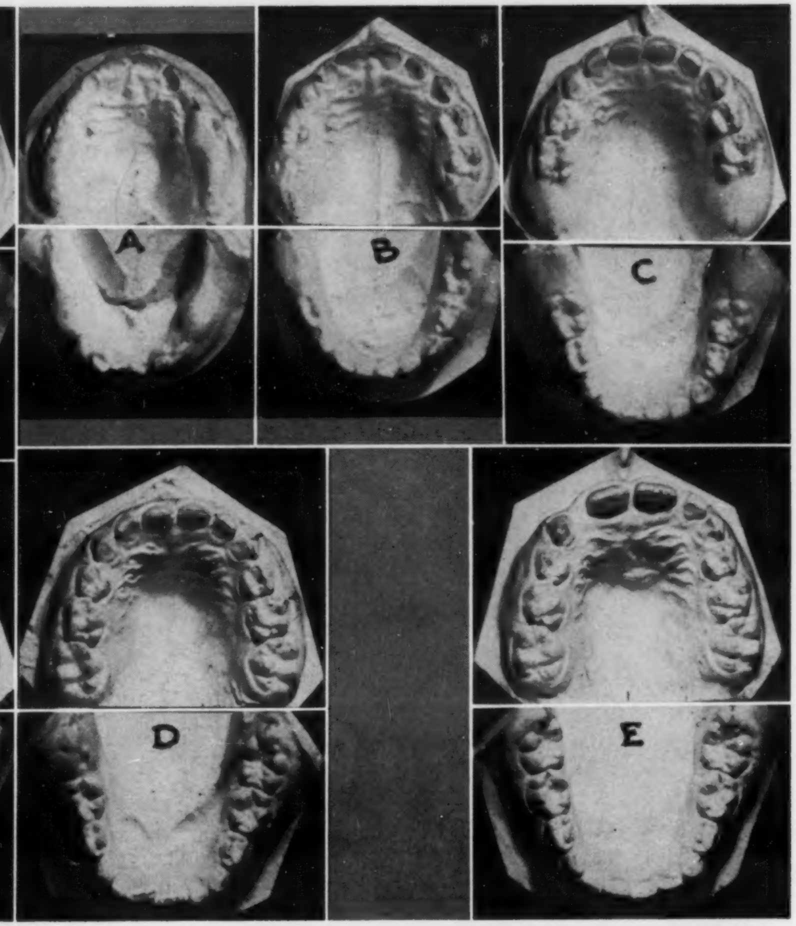


Fig. 5.

Fig. 4.—Occlusal view of twin A. B. showing resemblance of arch form to twin D. B. Note that in twin A. B., who is right-handed (cast *B*), the right maxillary second deciduous molar is present. Cast *E* shows that there is a retained maxillary right deciduous lateral incisor and that the left lateral incisor has been shed. *A*, 1 year, 3 months; *B*, 2 years, 4 months; *C*, 5 years, 6 months; *D*, 6 years, 3 months; *E*, 7 years, 2 months.

Fig. 5.—Occlusal view of twin D. B. Note the resemblance of arch form to twin A. B. Note that in twin D. B., who is left-handed, the order of erution, retention, and shedding of teeth is the reverse of his twin (casts *B* and *E*). *A*, 1 year, 3 months; *B*, 2 years, 4 months; *C*, 5 years, 6 months; *D*, 6 years, 3 months; *E*, 7 years, 2 months.

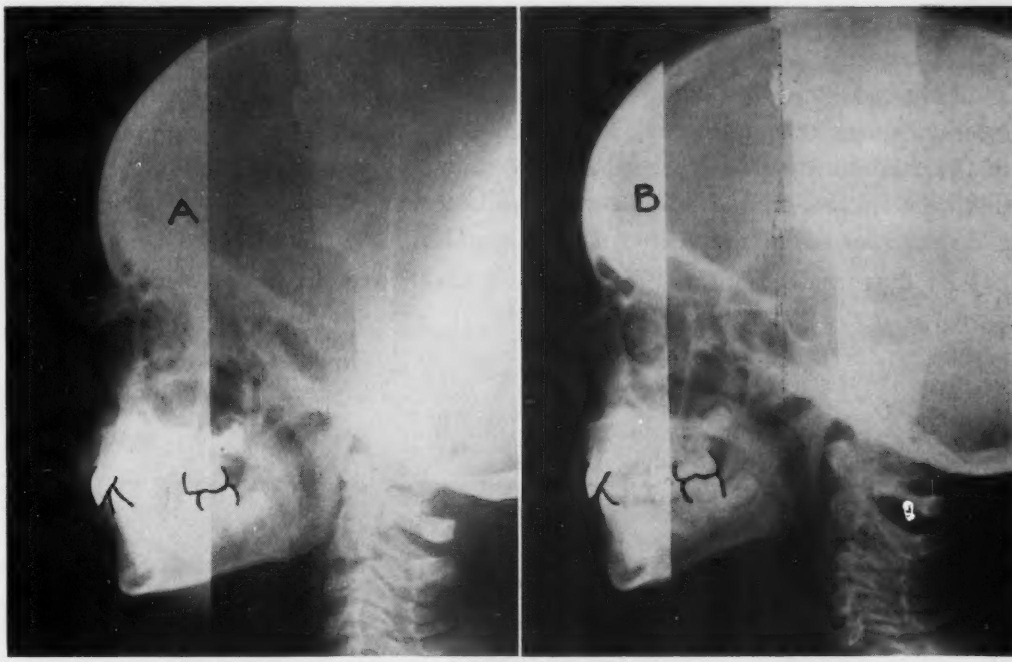


Fig. 6.—Cephalograms of the identical twins at 7 years 2 months of age show the resemblance of bone structures. Twin A. B. has a greater horizontal and vertical overbite and a more distal occlusion. *A*, Twin A. B.; *B*, twin D. B.

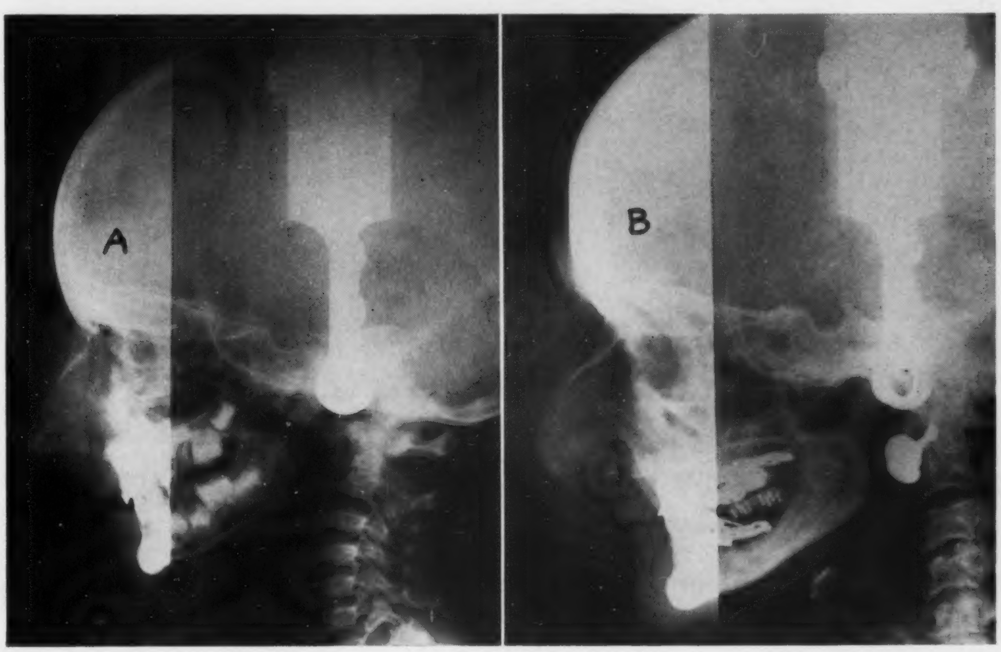


Fig. 7.—The cephalograms of daughter (*A*) and mother (*B*) show a disorder called progeria. Note the resemblance of soft and hard tissues. The difference in the outline of the mother's nose is due to plastic surgery. Note the absence of protrusion in both profiles. (The soft tissue outline was obtained by screening the appropriate portion of the film with film paper and placing it within the cassette. Reported in 1942 by the author.) *A*, Daughter at 5 years, 10 months; *B*, mother at 36 years, 1 month (wearing partial dentures).

Another case is presented of a daughter and mother who have a disorder called *progeria*, which gives the appearance of premature senility. This gross anomaly is believed to be of congenital endocrine origin. Comparison of the lateral cephalograms (Fig. 7) of the daughter (aged 5 years 10 months) and of the mother (aged 36 years 1 month) showed the marked resemblance, particularly in the mandible. The main difference appears to be one of size. Note the absence of protrusion in both profiles.

At 5 years 10 months, the daughter's lower incisal roots seemed to show a retarded development and were lacking in alveolar process. Many of her deciduous teeth were hypoplastic. Her wrist roentgenogram was normal for her age (Todd's standard). At 9 years 4 months, she had good molar relationship, with only the maxillary second incisors in linguoversion.

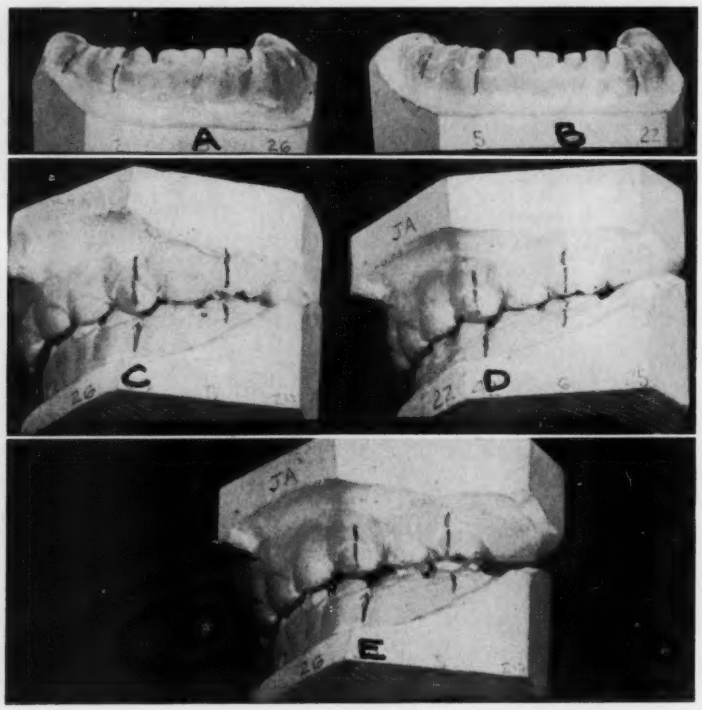


Fig. 8.—Cast of child J. A., who had an excellent ontogenetic development of occlusion from birth to 17 years. *A*, Front view of mandibular cast at 2 years, 6 months; *B*, front view of mandibular cast at 5 years, 6 months (note the increase in spacing between the incisors); *C*, left side view at 2 years, 6 months; *D*, left side view at 5 years, 6 months; *E*, left side view with the maxillary cast at 5 years, 6 months occluded with the mandibular cast at 2 years, 6 months (note the marked change in the occlusal relationship).

Let us now examine some occlusal changes that occur in the deciduous dentition with spacing between the teeth. These changes are often subtle, and unless they are viewed from many aspects, one is likely to be misled. As an example, the casts of child J. A. showed an excellent ontogenetic development from birth to 17 years of age. His casts (Fig. 8) at $2\frac{1}{2}$ and $5\frac{1}{2}$ years, respectively, showed increased spacing between the mandibular incisors. The

spacing had increased between other teeth to a less obvious extent. However, the general pattern of spacing is maintained. Although these growth changes may not be seen or measured interdentally, they can be measured as an arch change. These changes can be visualized by taking casts of the completed deciduous dental phase at different ages and articulating the maxillary cast of the older age with the mandibular cast of the younger age. Even when there is crowding in the incisal region, change in arch dimensions may be observed.

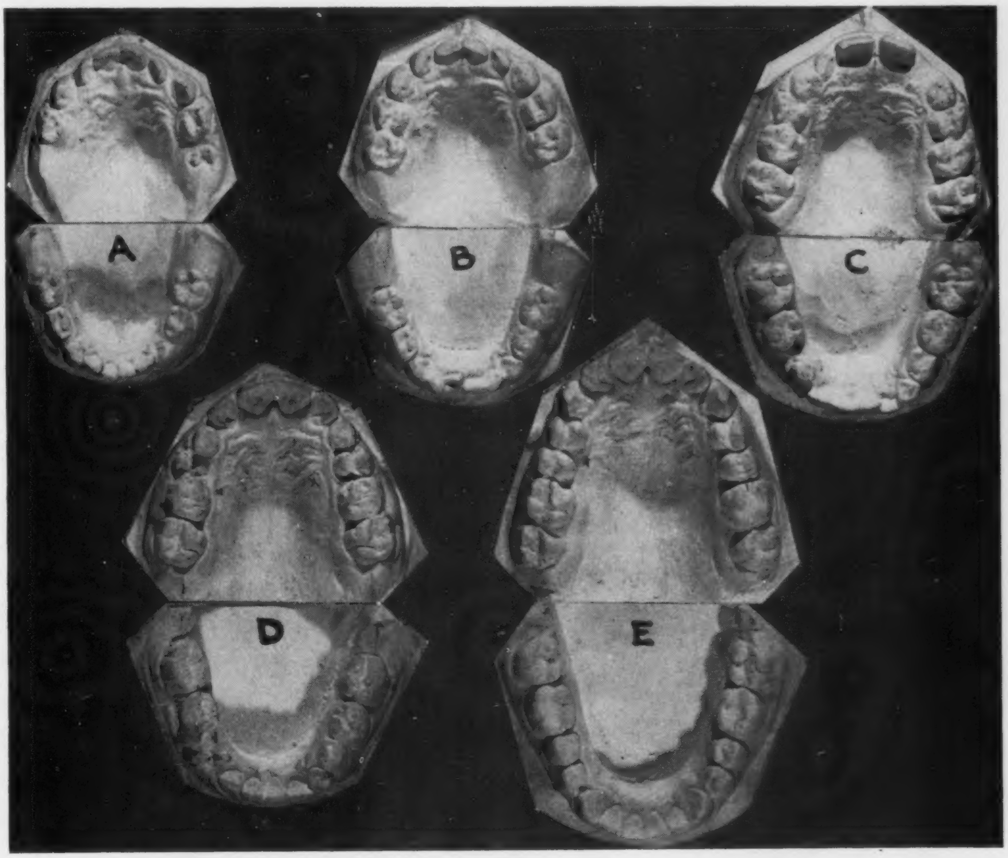


Fig. 9.—Occlusal views of child S. L. *A*, At 2 years, 5 months (note the absence of spacing and the crowding of the mandibular deciduous incisors); *B*, at 5 years, 10 months (note the mandibular permanent first right incisor in linguoversion); *C*, at 8 years, 5 months (note the mandibular second left incisor in labioversion); *D*, at 10 years, 6 months (same as above, with some inprovement); *E*, at 17 years (note the satisfactory arrangement of all the teeth). The child has good occlusion as well.

Another aspect of occlusal changes is seen in child S. L. (Fig. 9), who had incisal crowding at 1 year of age. At 5 years 10 months, the mandibular permanent right first incisor was in linguoversion and crowded but, with time, corrected itself. At 8 years 5 months, the mandibular second left incisor was in labioversion and crowded, and again time was a kind therapist. At 17 years, without any treatment, he had only minor irregularities.

Let us now go from the general discussion of occlusion to an analysis of some serial material gathered over a period of twenty years. This material presents good and poor occlusion (nontreated) as well as treated cases.

Before the actual dimensions are examined, the serial casts and salient points in the serial histories will be presented.

First, four children showed good occlusal development (Fig. 10) from birth through eruption of their second permanent molars. Child J. A. had a normal medical history but was bottle-fed until the age of 7 years. Child

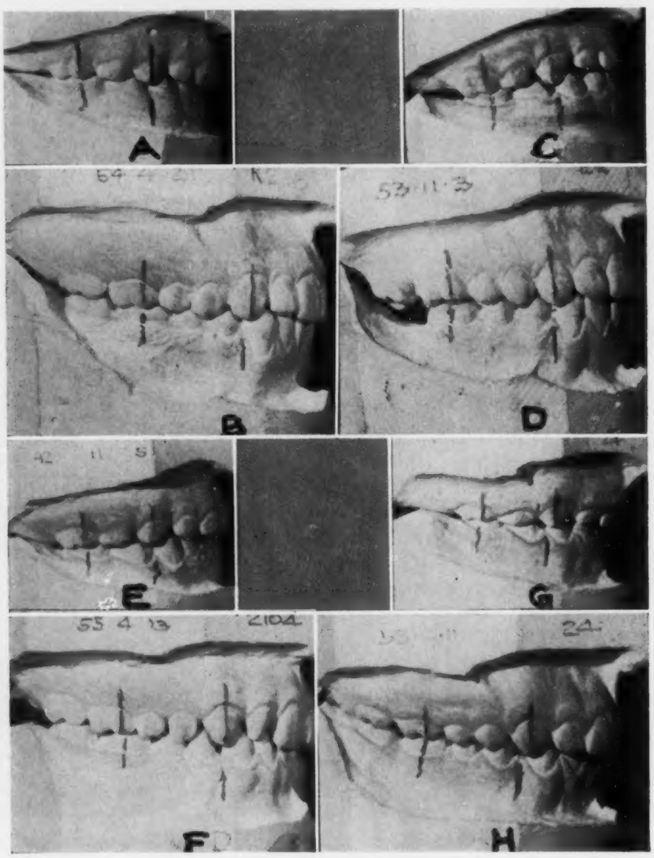


Fig. 10.—Serial casts of right side views of four children with good occlusion. *A*, Child J. A. at 3 years, 6 months; *B*, child J. A. at 17 years, 5 months; *C*, child D. M. at 4 years, 2 months; *D*, child D. M. at 16 years, 7 months; *E*, child S. D. E. at 4 years, 6 months; *F*, child S. D. E. at 16 years, 11 months; *G*, child R. A. at 5 years, 10 months; *H*, child R. A. at 16 years, 1 month.

D. M. also had a normal medical history, but sucked his thumb until 7 years of age. In these two children, neither the prolonged bottle feeding nor the thumb-sucking had any noticeable effect on their excellent occlusions. Children S. D. E. and R. A. had good occlusions, with a slight vertical overbite and some spaces between their teeth. These children had numerous colds.

In addition, child S. D. E. had large, infected tonsils and adenoids (Fig. 11) which practically closed off the pharynx. The important fact to note is that the relatively good occlusion was maintained by both children.

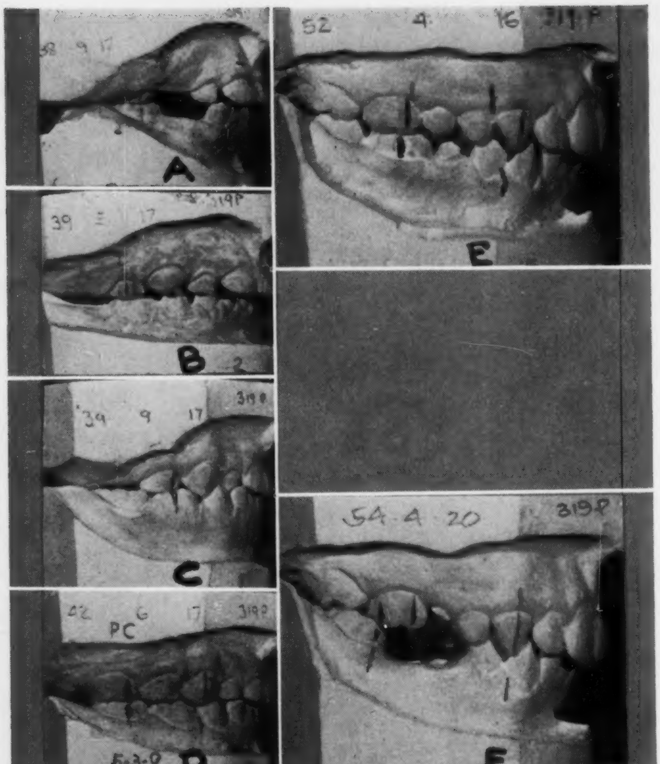
The following four children had poor occlusion. Child P. C. (Fig. 12) and child B. C. (Fig. 13) are brothers with similar medical histories. The casts of child P. C. at 14 months showed the maxillary second incisors in a lingual position. The casts for child B. C. at 6 months showed his gum pads deformed, and at 14 months his maxillary second incisors were at a 45 degree angle to the arch. Child B. C. sucked his thumb for more than nine years. This was an accentuating factor of his existing poor occlusion, as indicated by an objective study of the serial models made before the habit started, while it was in progress, and after it ceased. In addition, four siblings in this family who did not suck their thumbs had some degree of poor occlusion.

Fig. 11.—Photograph showing child S. D. E.'s enlarged and infected tonsils which practically closed off the oropharynx.

Child M. F., at 1 year 8 months, showed a marked horizontal overbite (Fig. 14). At 3 years 8 months, the marked overbite was spontaneously corrected. This type of spontaneous correction also occurred in other cases. At 11 years 9 months, a good occlusion was present in spite of the loss of many deciduous teeth. Continued dental neglect resulted in the loss of permanent teeth. At the ages of 14 years 8 months and 16 years 5 months, the vertical overbite progressively increased, while the normal tendency is the reverse. The median line had shifted to the right. This is an example of how good occlusion may be changed into poor occlusion.

Child L. R. (Fig. 15) also had a poor occlusion. Her medical history was normal. She received excellent dental care. The deciduous dentition showed some crowding of the incisors of both arches, which became more irregular in the permanent dentition. The lateral cephalogram (Fig. 16) at 17 years 8 months showed alveolar prognathism.

Fig. 12.



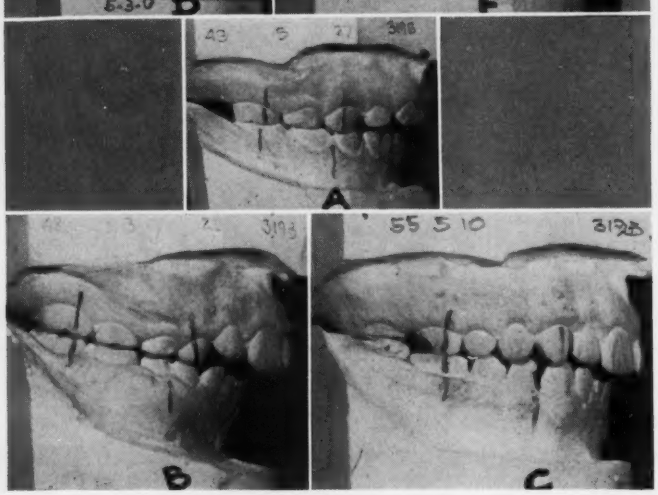


Fig. 13.

Fig. 12.—Right views of child P. C. with poor occlusion. *A*, at 1 year, 6 months (note edge-to-edge occlusion of the right lateral incisors); *B*, at 2 years, 1 month (note the position of the maxillary right lateral incisor); *C*, at 2 years, 6 months, the same tooth in linguoversion; *D*, at 5 years, 3 months, the maxillary right lateral incisor has spontaneously corrected its position; *E*, at 15 years, the maxillary incisors had some protrusion; *F*, at 17 years, 1 month, the anterior position of the arches have remained practically the same. There are a 3 mm. horizontal overbite, many rotations, and other occlusal defects.

Fig. 13.—Right side view of child B. C. with poor occlusion. *A*, At 5 years, 2 months, overbite partially due to thumb-sucking; *B*, at 10 years, overbite at time that active thumb-sucking was stopped; *C*, at 17 years, 1 month, overbite has lessened.

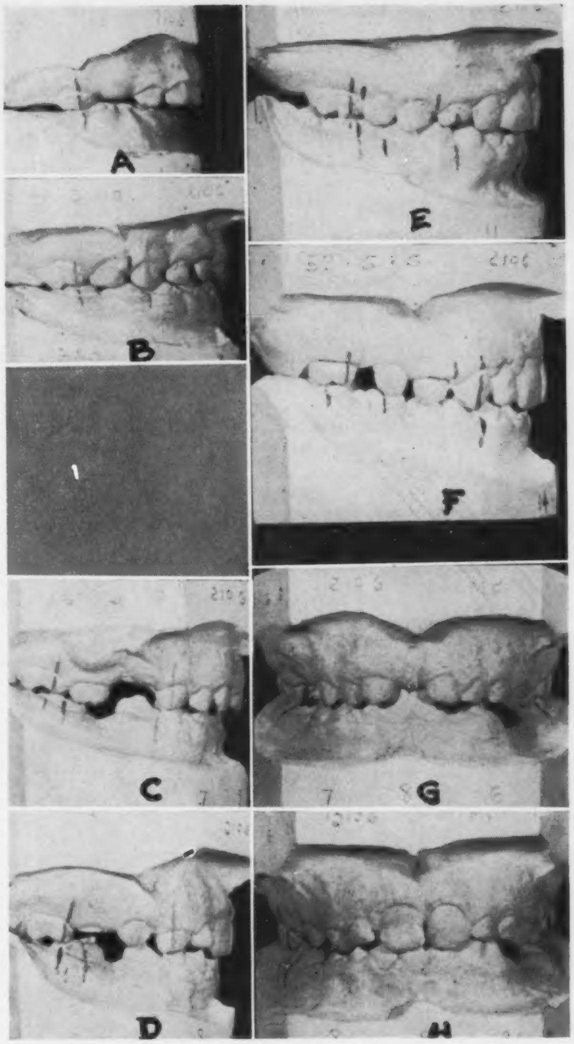


Fig. 14.—Right side and front views of child M. F. *A*, At 1 year, 8 months, horizontal overbite; *B*, at 3 years, 8 months, the overbite has corrected itself; *C*, at 7 years, 8 months, note changes in occlusion; *D*, at 8 years, 10 months, note further changes in occlusion; *E*, at 11 years, 10 months, note the good occlusion; *F*, at 14 years, 8 months, the vertical overbite has increased; *G*, at 7 years, 8 months, note marked space between maxillary deciduous incisors; *H*, at 8 years, 10 months, there are no spaces between the permanent incisors.

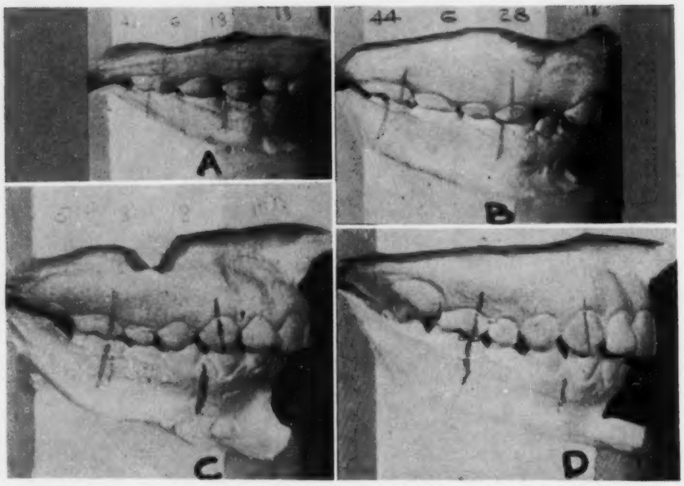


Fig. 15.—Right side views of child L. R. with poor occlusion. *A*, At 4 years, 3 months, note Class II tendency; *B*, at 7 years, 3 months; *C*, at 13 years, 5 months, note the alveolar prognathism in both arches; *D*, at 17 years, 8 months, the second molar is in buccoversion.

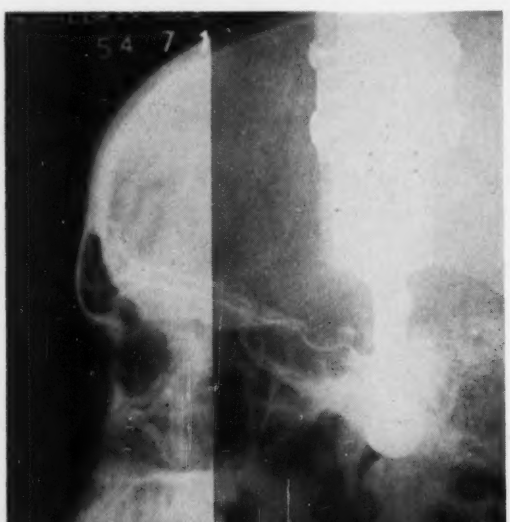


Fig. 16.—Cephalogram of child L. R. showing the alveolar prognathism at 17 years, 8 months.

I will now present case reports of six children who received orthodontic treatment. The first four treated children had little crowding of the teeth similar to the nontreated children (good and poor occlusion). A comparison between the treated and nontreated cases may provide some insight as to the changes that occur during maturation and those changes that result from orthodontic treatment.

Child B. H. had a Class I malocclusion (Fig. 17), as seen by the casts at 7 years 10 months and 11 years 8 months. At 13 years 4 months, when active orthodontic treatment was completed, there were some spaces between the incisors. Nevertheless, the result of the treatment was satisfactory. The records at 21 years 8 months showed that the spaces closed spontaneously, resulting in an improved occlusion.

Child H. G. (Fig. 18) had a Class I malocclusion. The casts at 10 years 2 months before treatment, at 11 years 9 months after treatment, and at 19 years 10 months follow-up showed the satisfactory result obtained.

Child C. M. had a Class II malocclusion (Fig. 19) at 7 years 5 months and 10 years 9 months. There were no detrimental habits to account for the overbite. The child had twenty-eight months of active treatment. Her records at 13 years 10 months following treatment, and at 18 years 8 months follow-up showed the excellent result of therapy.

Child A. R. also had a Class II malocclusion (Fig. 20) with a horizontal overbite of 15 mm. The casts at 11 years 4 months showed the occlusion prior to treatment. At 12 years 6 months a satisfactory result was obtained at the end of treatment. The later records at 18 years and 23 years showed a slight relapse. Treatment was terminated before the second molars were in place, which might account for some of the relapse.

Fig. 21 shows the follow-up cephalograms of these four treated cases. Note the difference in the degree of protrusion in each profile.

The following two treated cases are unusual because of the severe vertical overbite and crowding. They are good examples of what has been accomplished by adhering to the concept of occlusion as advocated by Angle.

Child C. O. (treated by Dr. Abraham Lees) had a Class II, Division 2 malocclusion (Fig. 22) with severe vertical overbite of 18 mm. at 14 years 3 months. The case was completed at 17 years 1 month, and the follow-up at 27 years 1 month showed the excellent result.

Child D. B. (treated by the late Dr. F. Tolmach) had a Class I malocclusion (Fig. 23) with severe mandibular incisal crowding. Treatment was started at the age of 17 years. Casts were made three years later when treatment was completed at the age of 20 years, and again at 39 years of age. The slight relapse and some rotations of teeth are minor, considering the service rendered.

Now let us analyze the measurements of all the nontreated and treated cases. A simple system of spatial measurement was devised and is suggested for your use and evaluation. Measurements were taken from the incisors, canines, and molars (Fig. 24). The incisal point is the intersection of a line

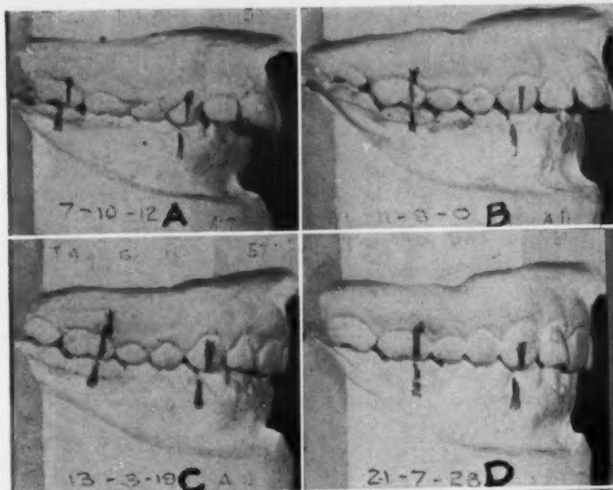


Fig. 17.

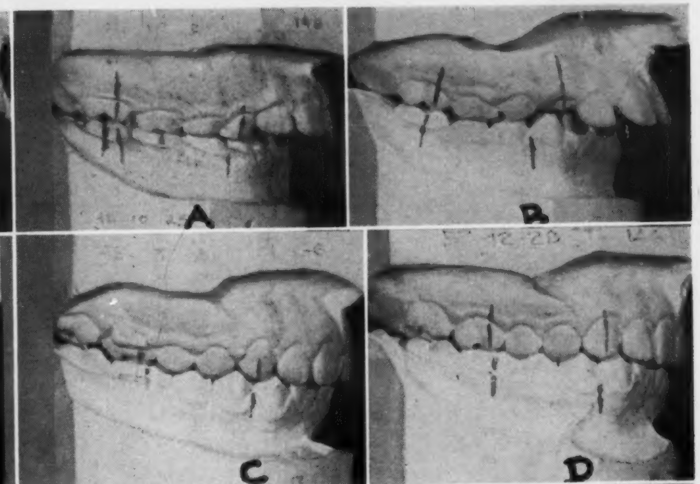


Fig. 18.

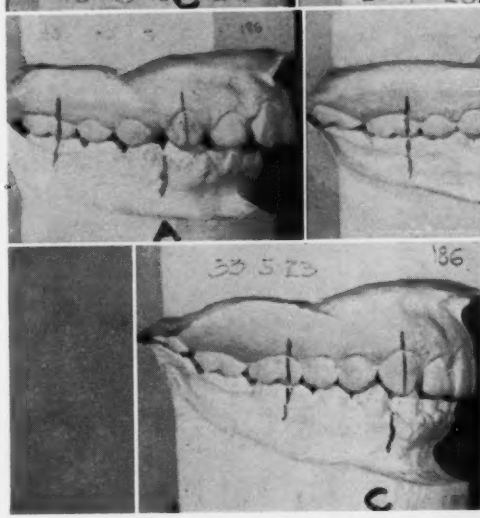


Fig. 19.

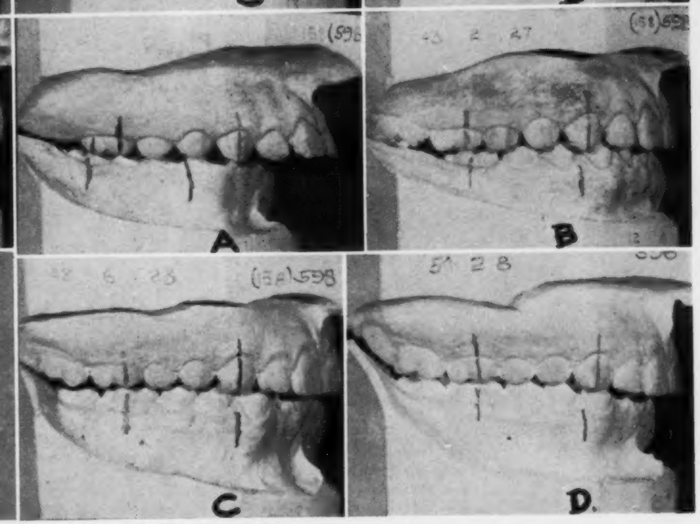


Fig. 20.

Fig. 17.—Right side views of child B. H. *A*, At 7 years, 10 months; *B*, at 11 years, 8 months, before treatment; *C*, at 13 years, 4 months, after treatment; *D*, at 21 years, 8 months, improved occlusion.

Fig. 18.—Right side views of child H. G. *A*, At 10 years, 2 months, note the alveolar prognathism before treatment; *B*, at 11 years, 9 months, after treatment; *C*, at 19 years, 10 months, the follow-up record.

Fig. 19.—Right side views of child C. M. with a Class II, Division 1 malocclusion. *A*, At 7 years, 5 months; *B*, at 10 years, 9 months, prior to start of active treatment; *C*, at 13 years, 10 months, showing completed case after 2 years, 4 months of treatment; *D*, at 18 years, 8 months, the follow-up record.

Fig. 20.—Right side views of child A. R. with Class II, Division 1 malocclusion. *A*, At 11 years, 4 months, prior to active treatment; *B*, at 12 years, 6 months, before all second molars had erupted, treatment was terminated; *C*, at 18 years; *D*, at 23 years, 7 months, note the relapse with the second molars in poor position.

VOLUME TIGHT

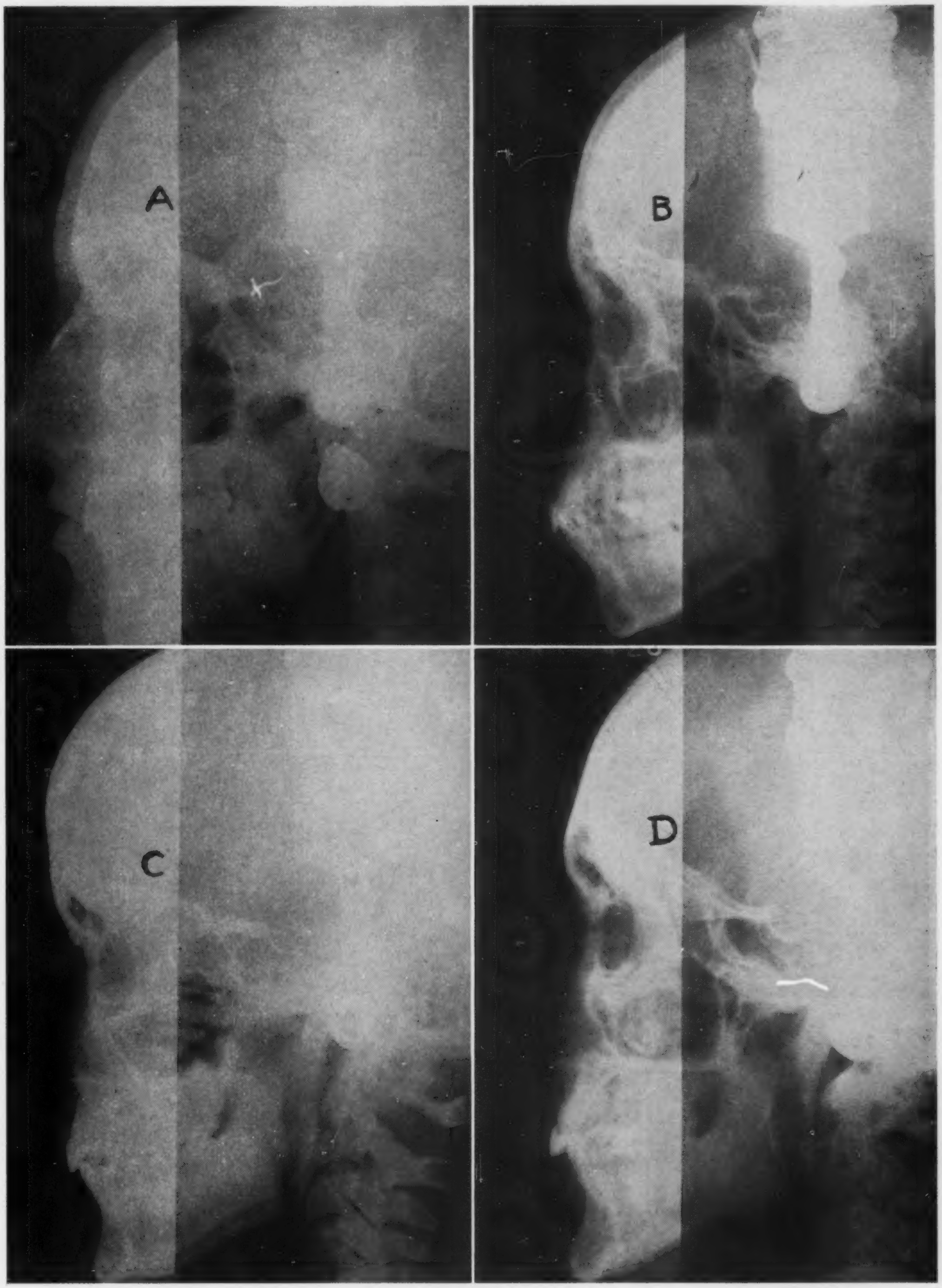
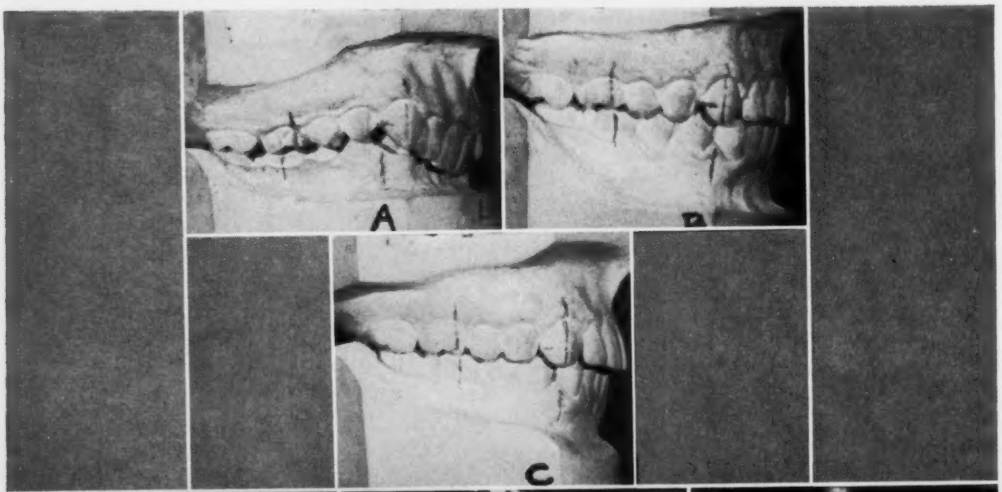


Fig. 21.—Follow-up cephalograms of the treated cases. *A*, Child B. H. (21 years, 8 months); *B*, child H. G. (19 years, 10 months), note alveolar prognathism; *C*, child C. M. (18 years, 8 months); *D*, child A. R. (23 years, 7 months).

Fig. 22.



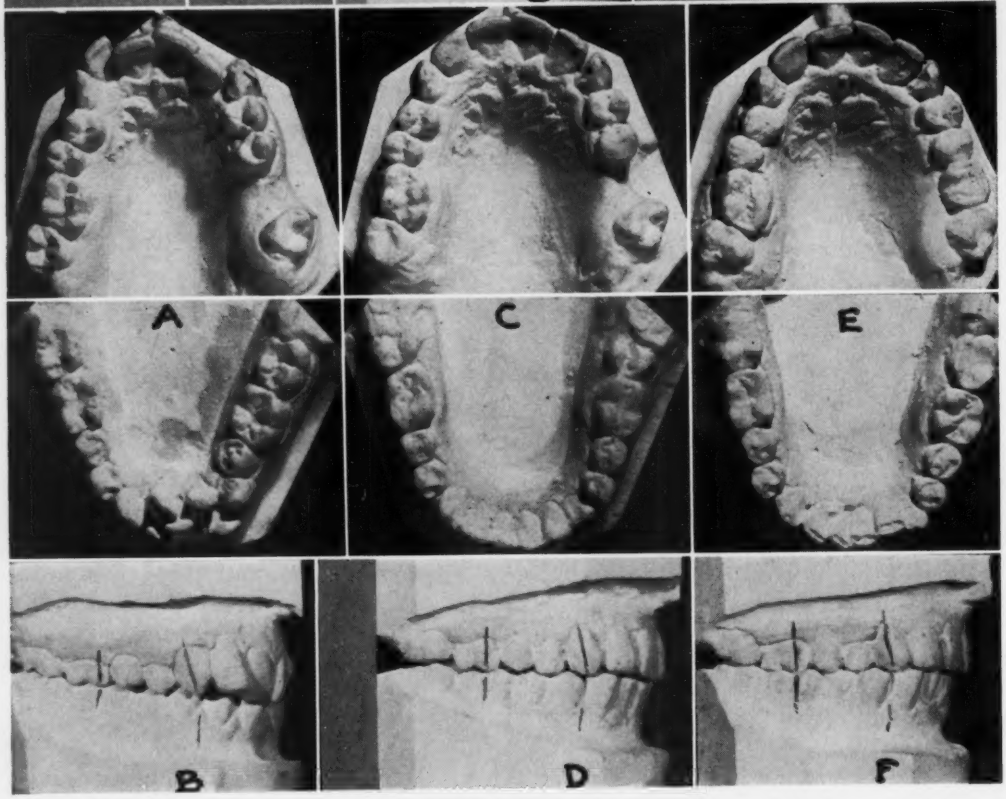


Fig. 23.

Fig. 22.—Right side view of child C. O. with Class II, Division 2 malocclusion. *A*, 14 years, 3 months; *B*, 17 years, 1 month; *C*, 27 years, 1 month. (Courtesy of Dr. A. Lees.)

Fig. 23.—Casts of child D. B. *A*, Occlusal view at 17 years (before treatment); *B*, right side view at 17 years; *C*, occlusal view at 20 years (after treatment); *D*, right side view at 20 years; *E*, occlusal view at 39 years (follow-up); *F*, right side view at 39 years. (Courtesy of Dr. A. Rudner.)

drawn through the middle of the incisal surfaces and the median line of the dental arch. The canine point is located by a line drawn through the distal border of the canine at the level of the mesial ridge of the adjacent tooth. The molar point is the mesial groove of the 1st molar at the level of its ridge. The vector dimensions on the right and left sides are taken from incisal to canine points (*CV*) and molar points (*MV*). The width of the dental arch is taken between canine points (*CW*) and molar points (*MW*).

In addition to these measurements, the width of rugae was recorded between two clearly defined points of the rugae in the region of the first deciduous molars or premolars.

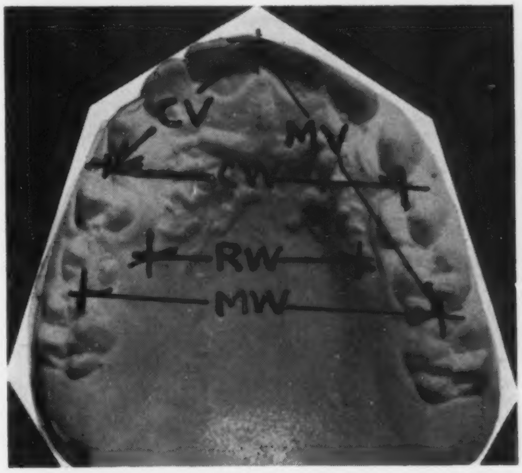


Fig. 24.—Occlusal view of maxillary cast showing the dimensions taken. The dimensions for the mandibular casts are the same, except that there is no *RW* dimension. *CV*, Canine vector; *MV*, molar vector; *CW*, canine width; *MW*, molar width; *RW*, width of rugae.

This dimension is a measure of palatal width. All points were marked on the casts and measurements were taken with a vernier caliper to the nearest 0.1 mm.

Each series was divided into physiologic phases:

Deciduous phase (*D*) is the completed deciduous dentition.

Mixed phase (*M*) includes all permanent first molars and all mandibular incisors.

P. 1 phase includes all permanent teeth and all first molars or some second molars and some deciduous teeth.

P. 2 phase includes all permanent teeth except the third molars.

P. 3 phase includes all permanent teeth, including the third molars.

The material was divided in this manner for simplicity and in order to make a fair comparison of all the cases. Measurements for the dental and chronological age are given in Tables I to XIV.

Considering the cases of good occlusion (Tables I to IV) as a group, all dimensions except one for the deciduous phase were the smallest in both the maxilla and the mandible. Generally, there was an increase of dimensions from

the deciduous to the mixed phases for both arches. The change in dimensions from the mixed to the permanent phases varied. During phases P. 1 to P. 2, practically all dimensions for children J. A. and D. M. remained constant or

TABLE I. CHILD J. A.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
		Dimensions of Maxillary Dental Arch						
D	4 yrs. 6 mos.	20.5	34.8	20.0	35.0	34.5	43.4	23.9
M	7 yrs. 5 mos.	21.4	35.6	22.5	37.4	36.4	45.0	25.3
P. 1	14 yrs. 5 mos.	23.5	37.4	24.0	37.8	38.0	46.6	28.7
P. 2	17 yrs. 5 mos.	23.0	35.6	22.0	36.1	36.6	45.7	28.4
		Dimensions of Mandibular Dental Arch						
D	4 yrs. 6 mos.	15.0	31.0	15.0	31.0	27.0	37.5	
M	7 yrs. 5 mos.	16.8	32.2	16.4	32.2	29.8	38.4	
P. 1	14 yrs. 5 mos.	18.0	31.3	18.4	31.6	31.8	38.4	
P. 2	17 yrs. 5 mos.	18.0	30.4	18.3	30.4	31.3	36.7	

TABLE II. CHILD D. M.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
		Dimensions of Maxillary Dental Arch						
D	4 yrs. 2 mos.	19.4	33.8	19.4	34.0	31.1	40.6	22.5
M	7 yrs. 4 mos.	21.8	35.8	21.2	35.4	32.3	43.2	24.2
P. 1	12 yrs. 2 mos.	23.6	35.6	22.5	35.0	36.0	43.2	27.0
P. 2	16 yrs. 7 mos.	23.2	35.0	23.2	34.2	34.8	43.2	28.0
		Dimensions of Mandibular Dental Arch						
D	4 yrs. 2 mos.	15.0	31.2	15.0	31.0	26.6	35.2	
M	7 yrs. 4 mos.	16.4	32.8	17.1	32.2	29.2	38.4	
P. 1	12 yrs. 2 mos.	17.3	32.6	17.7	31.2	29.2	39.6	
P. 2	16 yrs. 7 mos.	17.3	30.2	17.3	30.2	29.6	38.5	

TABLE III. CHILD S. D. E.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
		Dimensions of Maxillary Dental Arch						
D	4 yrs. 6 mos.	19.4	34.0	19.9	33.8	32.6	43.2	22.3
M	7 yrs. 11 mos.	22.4	36.0	22.0	36.0	34.8	43.6	23.7
P. 1	12 yrs. 11 mos.	24.0	36.4	23.0	36.4	37.2	46.3	26.7
P. 2	16 yrs. 11 mos.	23.2	34.0	23.0	36.0	38.0	46.0	28.0
		Dimensions of Mandibular Dental Arch						
D	4 yrs. 6 mos.	14.0	29.0	14.0	30.0	25.6	38.2	
M	7 yrs. 11 mos.	15.2	30.0	16.4	31.6	29.0	38.0	
P. 1	12 yrs. 11 mos.	16.7	29.4	18.0	30.2	30.0	39.0	
P. 2	16 yrs. 11 mos.	17.0	28.4	16.4	29.0	30.2	39.0	

decreased. During the same period, the dimensions for children S. D. E. and R. A. showed greater variation. The fact that the latter two children had spaces between their permanent teeth may account for some of the differences.

In the cases of poor occlusion (Tables V to VIII) the variation in dimensions is greater than in the cases of good occlusion. The dimension of interest is the width of rugae (*RW*) for child L. R. The total change of width of rugae

TABLE IV. CHILD R. A.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
D	4 yrs. 1 mo.	19.0	33.0	19.2	34.0	32.5	38.4	22.8
M	7 yrs. 9 mos.	21.5	35.0	22.0	35.8	35.3	43.2	26.0
P. 1	12 yrs. 1 mo.	22.4	36.7	23.0	38.3	35.5	44.2	26.8
P. 2	16 yrs. 1 mo.	23.4	35.5	24.2	37.0	37.2	44.3	29.0
Dimensions of Mandibular Dental Arch								
D	4 yrs. 1 mo.	16.0	30.0	15.0	30.8	25.8	36.0	
M	7 yrs. 9 mos.	16.4	30.8	16.4	31.4	28.4	39.0	
P. 1	12 yrs. 1 mo.	17.0	31.6	16.8	33.0	27.0	39.9	
P. 2	16 yrs. 1 mo.	17.2	30.8	17.0	31.4	27.3	39.3	

TABLE V. CHILD P. C.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
D	3 yrs. 9 mos.	20.6	36.2	20.4	36.4	33.4	42.0	20.0
M	8 yrs. 1 mo.	22.2	33.0	21.5	36.0	35.7	40.7	23.0
P. 1	12 yrs.	24.2	32.5	22.7	37.5	36.0	42.3	24.0
P. 2	17 yrs. 1 mo.	24.0	35.0	24.0	35.0	37.0	44.0	25.0
Dimensions of Mandibular Dental Arch								
D	3 yrs. 9 mos.	11.0	32.6	16.5	33.5	27.0	38.0	
M	8 yrs. 1 mo.	17.0	33.0	16.0	33.0	30.0	39.6	
P. 1	12 yrs.	18.6	31.9	18.4	32.3	30.0	39.0	
P. 2	17 yrs. 1 mo.	19.0	32.0	19.0	35.0	31.4	44.5	

TABLE VI. CHILD B. C.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
D	4 yrs. 3 mos.	19.5	36.6	19.5	35.5	30.0	40.8	21.0
M	8 yrs. 1 mo.	21.5	36.6	22.0	37.0	32.0	42.0	23.0
P. 1	12 yrs.	21.7	38.2	22.2	38.1	32.8	42.8	24.5
P. 2	17 yrs. 1 mo.	23.8	35.4	23.0	35.0	37.0	42.0	26.5
Dimensions of Mandibular Dental Arch								
D	4 yrs. 3 mos.	16.0	30.0	15.0	30.0	28.0	35.4	
M	8 yrs. 1 mo.	16.8	31.4	17.2	32.0	30.5	37.0	
P. 1	12 yrs.	19.5	31.8	18.8	32.0	32.0	38.2	
P. 2	17 yrs. 1 mo.	17.6	30.0	18.6	31.0	32.4	39.0	

TABLE VII. CHILD M. F.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
D	3 yrs. 8 mos.	19.0	32.5	20.0	34.0	32.0	40.3	21.0
M	8 yrs. 9 mos.	21.3	35.0	20.0	35.0	33.4	41.0	22.8
P. 1	10 yrs. 7 mos.	22.2	35.2	21.0	35.2	33.2	41.0	23.5
P. 2	16 yrs. 5 mos.	23.0	36.2	21.2	33.0	35.1	41.8	23.5
Dimensions of Mandibular Dental Arch								
D	3 yrs. 8 mos.	14.6	30.0	14.8	29.2	24.4	35.0	
M	8 yrs. 9 mos.	16.4	27.0	16.0	30.0	25.6	34.0	
P. 1	10 yrs. 7 mos.	17.0	29.0	17.8	29.9	26.2	34.6	
P. 2	16 yrs. 5 mos.	16.0	28.2	17.5	32.0	26.5	36.0	

TABLE VIII. CHILD L. R.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
D	4 yrs. 3 mos.	19.0	32.0	19.0	34.0	31.0	37.4	22.0
M	7 yrs. 3 mos.	23.0	37.3	23.5	36.7	34.7	39.4	23.6
P. 1	13 yrs. 5 mos.	23.0	36.2	23.5	36.8	34.8	39.4	23.4
P. 2	17 yrs. 4 mos.	24.0	36.0	24.5	37.0	36.4	39.0	23.4
Dimensions of Mandibular Dental Arch								
D	4 yrs. 3 mos.	15.0	30.0	14.8	29.8	24.0	31.4	
M	7 yrs. 3 mos.	18.0	34.0	17.6	33.3	28.5	34.7	
P. 1	13 yrs. 5 mos.	18.8	32.5	18.6	32.6	28.2	33.0	
P. 2	17 yrs. 4 mos.	17.4	31.6	18.5	32.0	28.0	32.4	

from the deciduous to the P. 2 phase was only 1.4 mm. This dimension was rechecked three times with ten serial casts, with an average error of measurement of 0.2 mm.

In regard to the treated cases (Tables IX to XIV), the single underscored line indicates the approximate time that active treatment was started. The double underscored line indicates the time of completion of treatment. Note that the canine width was always increased in the maxilla at the end of treatment, and the molar width was increased with the exception of child C. M.

TABLE IX. CHILD B. H.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
M	7 yrs. 10 mos.	22.5	37.0	22.5	36.0	33.5	40.2	22.0
P. 1	11 yrs. 8 mos.	24.1	36.4	23.4	36.0	36.0	41.6	23.0
P. 2	13 yrs. 4 mos.	22.5	33.6	22.5	33.8	37.5	43.2	25.0
P. 2	21 yrs. 8 mos.	21.4	33.3	22.0	33.3	36.0	41.3	25.2
Dimensions of Mandibular Dental Arch								
M	7 yrs. 10 mos.	14.5	30.2	14.5	29.8	26.4	33.6	
P. 1	11 yrs. 8 mos.	16.8	28.0	16.3	28.0	28.3	34.3	
P. 2	13 yrs. 4 mos.	16.5	28.0	16.0	28.0	29.3	37.0	
P. 2	21 yrs. 8 mos.	16.3	28.0	16.2	28.0	27.5	34.8	

TABLE X. CHILD H. G.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
P. 1	10 yrs. 2 mos.	24.0	39.2	25.0	39.3	36.8	44.2	23.4
P. 2	11 yrs. 9 mos.	23.2	36.0	23.4	36.4	38.3	45.5	24.2
P. 3	19 yrs. 10 mos.	24.0	36.0	24.0	36.5	38.5	44.8	24.2
Dimensions of Mandibular Dental Arch								
P. 1	10 yrs. 2 mos.	18.2	31.1	18.0	32.5	29.0	37.9	
P. 2	11 yrs. 9 mos.	18.0	30.7	18.0	31.3	29.8	38.7	
P. 3	19 yrs. 10 mos.	18.3	30.5	18.0	31.3	29.4	38.0	

TABLE XI. CHILD C. M.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
D	5 yrs.	17.0	32.0	18.0	32.0	30.7	40.3	22.2
M	7 yrs. 5 mos.	23.0	38.0	22.5	38.0	33.0	42.8	24.2
P. 1	10 yrs. 9 mos.	23.0	40.0	23.7	39.2	33.0	45.4	24.6
P. 2	13 yrs. 10 mos.	22.5	36.0	22.8	36.0	37.5	44.5	27.0
P. 2	18 yrs. 8 mos.	22.0	35.0	22.0	35.3	36.0	45.4	26.8
Dimensions of Mandibular Dental Arch								
D	5 yrs.	13.8	28.0	13.8	28.0	24.2	36.0	
M	7 yrs. 5 mos.	14.2	30.0	14.7	30.0	25.7	38.0	
P. 1	10 yrs. 9 mos.	17.2	29.0	16.5	28.0	29.0	37.8	
P. 2	13 yrs. 10 mos.	17.0	30.0	17.0	30.0	30.7	37.7	
P. 2	18 yrs. 8 mos.	16.8	28.6	16.2	28.8	30.0	38.0	

TABLE XII. CHILD A. R.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
P. 1	11 yrs. 4 mos.	23.5	36.8	25.0	37.3	35.4	45.0	26.0
P. 1	12 yrs. 8 mos.	22.5	36.0	22.4	36.2	37.0	48.4	27.4
P. 2	18 yrs.	21.8	34.6	22.6	35.5	35.8	46.7	28.0
P. 2	23 yrs. 7 mos.	21.0	34.0	22.2	34.5	35.1	47.5	28.4
Dimensions of Mandibular Dental Arch								
P. 1	11 yrs. 4 mos.	17.0	30.0	16.8	30.0	28.0	38.8	
P. 1	12 yrs. 8 mos.	17.0	29.2	17.0	29.8	30.0	39.8	
P. 2	18 yrs.	16.0	29.0	17.0	29.0	29.0	39.0	
P. 2	23 yrs. 7 mos.	16.5	28.4	17.0	28.4	29.0	40.0	

TABLE XIII. CHILD C. O.

PHASE	AGE	RIGHT		LEFT		WIDTH		WIDTH OF RUGAE
		CV	MV	CV	MV	CW	MW	
Dimensions of Maxillary Dental Arch								
P. 2	14 yrs. 3 mos.	22.0	31.0	21.5	31.8	37.8	44.6	27.6
P. 2	17 yrs. 1 mo.	23.5	36.0	24.2	37.0	40.0	49.5	30.0
P. 2	27 yrs. 4 mos.	25.0	37.0	23.0	37.0	39.5	49.5	31.4
Dimensions of Mandibular Dental Arch								
P. 2	14 yrs. 3 mos.	15.5	24.5	17.0	26.6	29.5	38.0	
P. 2	17 yrs. 1 mo.	17.5	31.5	18.5	31.5	32.4	43.6	
P. 2	27 yrs. 4 mos.	17.8	30.0	18.2	31.0	31.6	43.0	

In the mandible, the canine width was always increased by the end of treatment, as was the molar width, except in child C. M. In children C. O. and D. B., all dimensions showed marked increases in both jaws. The magnitude of change in the treated cases should be of interest for the clinician.

The changes produced in order to correct the occlusion indicate that the dental arches were expanded, lengthened, or shortened and overbites were corrected. All these corrections have stood the test of time.

TABLE XIV. CHILD D. B.

PHASE	AGE	RIGHT CV	RIGHT MV	LEFT CV	LEFT MV	WIDTH CW	WIDTH MW	WIDTH OF RUGAE
			Dimensions of Maxillary Dental Arch					
P. 2	17 yrs.	16.5	37.0	15.2	48.0	29.4	51.8	22.0
P. 2	20 yrs.	19.4	40.0	18.0	50.5	33.0	53.5	23.7
P. 2	39 yrs.	19.0	40.0	17.4	48.5	32.0	52.0	23.0
			Dimensions of Mandibular Dental Arch					
P. 2	17 yrs.	9.5	35.4	11.5	36.0	19.0	41.0	
P. 2	20 yrs.	15.0	39.4	15.0	38.0	28.0	48.0	
P. 2	39 yrs.	14.0	38.0	13.5	40.0	25.8	48.0	

SUMMARY

1. In a group of eighteen children with good occlusion at the time of the completed permanent dentition, including the second molars, there were sixteen cases of good occlusion in the corresponding deciduous dentition.

2. In a group of twenty children with poor occlusion in their completed permanent dentition, nine had Class I and eleven had Class II malocclusions. In the corresponding deciduous dentition, six had Class I, nine Class II, and five had good occlusion. These figures indicate that in many cases occlusion is established early in life.

3. In a pair of identical twins, although the first-born had the advantages in weight, height, method of early feeding, and bone development, the second-born twin had the better occlusion.

4. In the deciduous dentition from 2½ years to 5½ years, the increase in interdental spaces can rarely be seen or measured; yet, measurable changes are reflected in the dental arches.

5. In two cases of excellent occlusion development from birth to 17 years, neither prolonged bottle feeding nor thumb-sucking impaired the occlusion.

6. In two cases of good occlusal development from birth to 17 years, there is a suggestion that the slight vertical overbite may have resulted from colds, enlarged and infected tonsils and adenoids, or spacing between the teeth.

7. In three cases of poor occlusal development from birth to 17 years, there are multiple factors operating. Thumb-sucking was an accentuating factor of the existing poor occlusion in one case. Loss of teeth was the main factor in changing a good occlusion to a poor one in one case.

8. In the six successfully treated cases presented, the dental arches were expanded, lengthened, or shortened, and overbites were corrected.

9. A simple system of spatial measurements has been suggested for objective evaluation of our casts.

The author wishes to thank Drs. W. F. Harrigan, L. E. Holt, and W. E. Studdiford of Bellevue Hospital, where part of this study was made. I am grateful to Dr. H. Bakwin

for his continued interest, and to the parents and children whose cooperation has made this study possible.

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APPLIANCES AT THE CROSSROADS

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WHENEVER I am asked to give a talk, my first reaction is, "What can I say that has not been said many times before?" Often I am appalled by the number of contributions that flood our journals each month. What contribution can I—or most anyone else, for that matter—make? Almost everything that I know or find out through experience and study has appeared in print in one place or another, often many years ago. Originality these days is a rare and precious distillate, something akin to the extract of *Hammus alabammus.* The saving grace for any essayist is that much of what has been said has been forgotten or overlooked. Then, too, there are infinite ways of arranging thoughts and concepts with varying degrees of emphasis. Finally, there is the "conditioned or selective" hearing of the listeners. Some are conditioned by a hard day at the office, some by too much to eat or drink, and some by a particular interest or disinterest in the subject under discussion. Even granting a keen interest, we often hear only what we want to hear. We look for pronouncements that will substantiate our own way of doing things. We nod vigorously in agreement when we hear a man commend our appliance philosophy and, incidentally, we think that he is pretty smart, too. Or we wall out or dismiss remarks that tend to undermine our confidence in our particular approach. (As Bill Bendix says, "My head's made up; don't confuse me!") This attitude is a logical consequence of things as they are today. Economically, times are excellent, practices are full, and fees are adequate. The demand for orthodontics increases by leaps and bounds, and there is a bumper crop of future patients. The social prestige of the orthodontist is near the top. Our ego receives so many inflationary pats during the day that it is small wonder that there is an occasional change in hat size.

In this article, I want to analyze, coldly and impassionately and objectively, my philosophies of treatment, my mechanotherapy, and my results, in the light of the most authoritative knowledge we have today. In the spirit of the occasion, I ask you to do the same, and when I ask myself some of these questions, I want you to ask yourselves the same questions.

CASE ANALYSIS

Case analysis will be discussed first, and then appliance philosophy, divorcing one from the other as much as possible.

Delivered before the Philadelphia Society of Orthodontists, April 27, 1956.

The first question is: "What is my approach to Class I malocclusions? Why? Can I justify it on the basis of research and run-of-mine results and not just selected 'finished' cases? Am I unwittingly a Tweed disciple, Bull disciple, Johnson disciple, or follower of any therapeutic dogma?"

Class I malocclusions, to me, are problems of arch length. There is a discrepancy between the amount of tooth material and the available basal bone. Why? Most of the time I do not know and turn to a teleologic search for the etiology. It is either premature loss or hereditary pattern, and often causation is obscure at best. I am less and less sure that *local* factors are important agents in most Class I malocclusions. True, they make convenient crutches, but many cases of so-called premature loss are autonomous—cases in which the organism itself got rid of the teeth spontaneously and not through caries. Is this not a symptom of a broader and more encompassing problem of pattern malocclusion? I do not know, but it makes pretty good sense to me now. Heredity—the predominance of the morphogenetic pattern—looms larger and larger as the probable basis for most Class I malocclusions, and for Class II and Class III problems, for that matter.

I find myself glibly telling the parent, "Your child probably inherited the teeth from one parent and the jaws from the other," or "You can't build a five-room house on a four-room foundation." Is this scientific fact, premise, or sales talk? First, thorough studies in genetics seem to indicate that facial characteristics show a strong but random selection of parental counterparts. No work has been precise enough actually to spot the genes which determine jaw size, tooth size, tooth shape, and color in the human being, although beautiful maps can be drawn of the genetic placement in the drosophila, or fruit fly, and fascinating combinations are shown as a result of predetermined crossbreeding. Nevertheless, outstanding authorities in the field, like Snyder[1] at the University of Oklahoma, Sicher[2] at Loyola University, and Krogman[3] at the University of Pennsylvania, feel it entirely possible and even likely that tooth size and jaw size may be controlled by different genes and thus may be inherited from one parent or the other. The work of Stockard,[4-6] at Cornell University, who experimentally cross-bred dogs and produced all sorts of combinations and malocclusions, is strong evidence to support this contention. Other investigators have noted the lack of malocclusion in isolated, relatively pure ethnic groups, with little or no racial admixtures. Despite this, I am undoubtedly on very shaky ground when I tell a parent that the child's jaws came from one parent and his teeth from another. It is just as conceivable that both came from the same parent and that the parent had a quite similar malocclusion, or maybe a combination of recessive genetic characters from grandparents or great grandparents is the basis for the existing morphology. Certainly, this is plausible. We just do not know enough about such matters yet and, until we do, convenient teleologic traps such as this become an irresistable attraction.

What about the five-room house on the four-room foundation? Do I say this to justify my appliance philosophy, to rationalize my thinking? After all, did not Angle say categorically that all teeth are essential for normal occlusion and, if put into normal function, they will develop normal bases? What about

expansion? What about these beautiful "before-and-after" cases, where expansion was obviously the major therapeutic aim and accomplished goal? As I analyze my opinions, it is imperative that I recognize that there is no "always" or "never" in physiology so long as the phenomenon of homeostasis or adaptability occurs. The frontiers of our knowledge are so near, but what does unbiased research and broad clinical experience tell me? I have had access to both, being associated in practice for five years with an outstanding Angle disciple, seeing my students' results, doing research and familiarizing myself with the research of others, and finally carrying on my own private practice. The question is not a simple paraphrase of Hamlet's soliloquy—"To expand or not to expand, that is the question." Rather, it is "when to expand, how much to expand, and when not to expand." Which cases are amenable to expansion and which are not? What is the common denominator, if indeed there be one? It was Angle[7] himself who said:

> We know that while all human faces are greatly alike, yet they differ. Lines and rules for their measurements have ever been sought by artists, and many have been the plans for determining some basic line or principle from which to detect variations from the normal, but no line, no measurement, admits of anything nearly like universal application. But that our efforts may be intelligently directed toward the ideal, some rule, some principle must guide us. If there be not some grand principle as a basis from which to reason, we must be but gropers in the dark—experimenters, guessers, with results which may cause embarrassment or even bitter regret.

In my philosophy, there are two major considerations affecting expansionist aims in orthodontic treatment. One is the role, the contributions of growth and development; the other is muscular function and balance. Supplemental considerations are available basal bone, tissue health, temporomandibular joint disturbances, future stability with erupting third molars, etc.

Nance's[8] work on arch predetermination and arch form made a profound impression on me when it was first published, and I was frankly skeptical. But the more cases I see, and the more unrestrained finished results that I follow (and I am not referring to models "grabbed" immediately after the removal of appliances, but records taken three, four, and five years later), the more sure I am that growth and development are relatively minor considerations as far as increase in arch length is concerned. This is particularly true in cases where an attempt is made to increase mandibular intercuspid width. Riedel's[9] study and observations are sobering evidence. The alveolar processes grow upward and outward in the lower jaw and downward and outward in the upper jaw on a slightly expanding arc from the age of 8 years on, but the change in arc from first molar to first molar is not very great in most cases. While isolated examples can be shown of significant change, it would be folly to look for it routinely. Growth is a significant factor in Class II therapy, but not in Class I cases. I do not have to show you my failures from the back shelf of my closet—you have your own (Fig. 1).

As for the role of musculature, the work of Rogers[10] was of great significance, and undoubtedly it was a major contribution to orthodontic learning. Like everything else, however, the pendulum swung too far to the extreme, and

experience must temper enthusiasm with results. Of *course*, muscular pressures affect tooth position! Here again we learn our lessons from pathology. Macroglossia not only moves teeth, but changes jaw shape (Fig. 2). Congenital aglossia may well leave the teeth jumbled in the center of the mouth like cords of wood (Fig. 3). Congenital cleft lip repair can restrict the maxillary arch

Fig. 1.—Mandibular casts of case in which intercuspid width was increased to correct incisor irregularities. *1*, Before treatment; *2*, after treatment; *3*, one year out of retention.

Fig. 2.—Profile view of maxillary and mandibular anterior segments of patient with macroglossia. Note the marked deformation of the supporting bone and the malposition of the teeth.

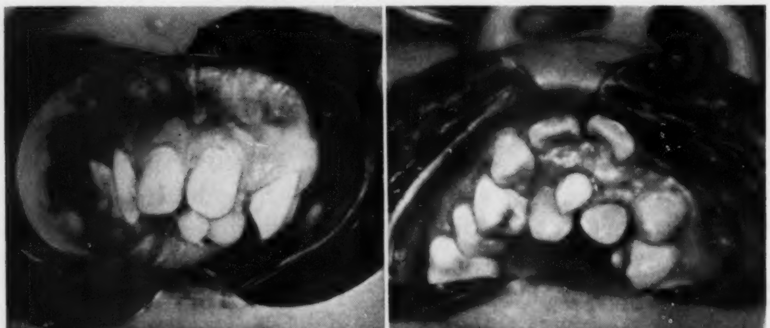


Fig. 3.—Malocclusion associated with a case of congenital aglossia. (From Eskew and Shepard: AM. J. ORTHODONTICS, February, 1949.)

like a steel vise (Fig. 4). Perversions of muscular function can cause severe malocclusions (Fig. 5). Less dramatic, but equally important, is the routine day-to-day job of oral, facial, and postural musculature, maintaining a status

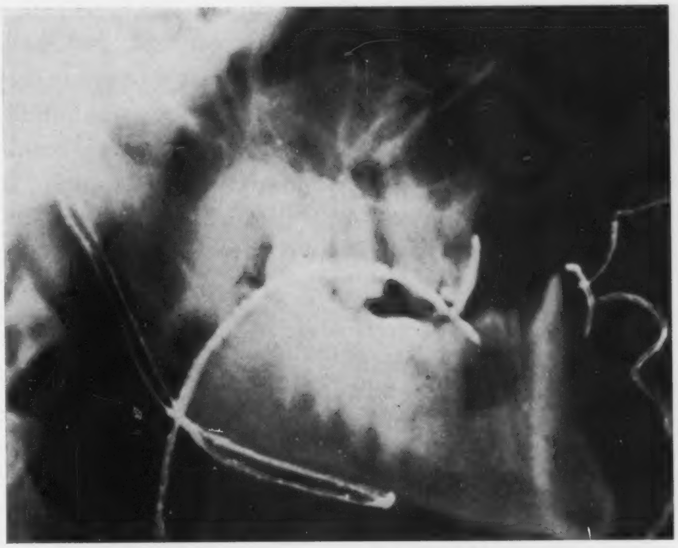


Fig. 4.—Cleft palate problem, with marked Class III relationship. Growth restriction and a short, tight, unyielding repaired cleft lip are major factors here.

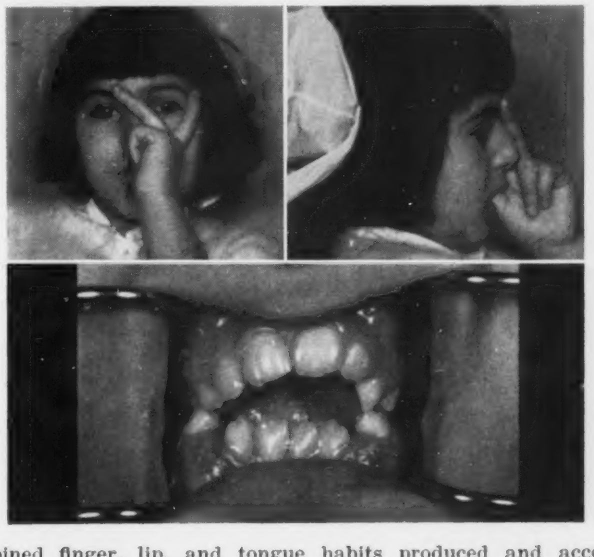


Fig. 5.—Combined finger, lip, and tongue habits produced and accentuated the illustrated malformation. Stable correction of the malocclusion is possible only with a change in extrinsic habit patterns.

quo not only of tooth position, but of head and jaw position as well. But can we lengthen muscles through exercise? Years of clinical experience with normal and cleft palate patients—taping lips together at night, giving patients lip exercises, lecturing patients and parents—lengthened no lip muscles for me.

Subsequent electromyographic study has unequivocably confirmed this clinical observation. We can change muscle functional levels, but we do not lengthen muscles, except by surgery, and then it is not the individual fibers. Again, we ask ourselves, "Can we change arch form, willy-nilly, disregarding muscular forces, and get away with it?" If we read some of the literature in print even today, the answer is "yes." I challenge this concept, not with a categoric denial, but with a conditioned, "I haven't seen it except in certain specific cases." These cases are those in which muscle forces are actually changed by altering the functional perversions associated with abnormal swallowing habits and other habits involving lips, tongue, or fingers. For example, in cases where the lower lip cushions to the lingual of the maxillary incisors in an excessive overjet, the mentalis muscle is hyperactive, buccinator pressures are excessive

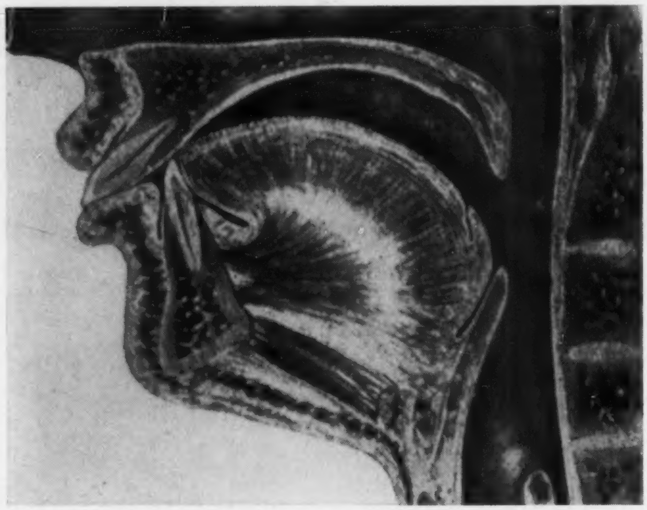


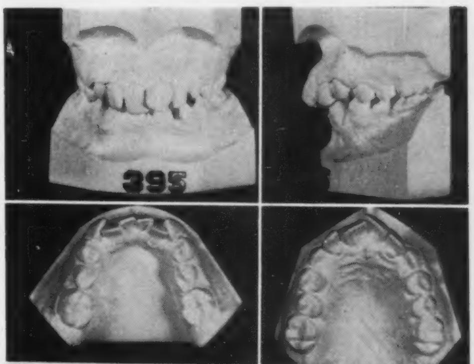
Fig. 6.—Drawing shows the perversion of perioral musculature, with the lower lip a forward-propelling force, restraining the lower anterior segment at the same time that it is propelling the maxillary incisors labially. (From Lischer: Principles and Methods of Orthodontics, 1912, Lea & Febiger.)

and restrictive to the lateral segments, and the tongue may well thrust forward against the lingual of the maxillary incisors during the actual swallowing act (Fig. 6). Here it is logical to look for bilateral narrowing of the dental arches. In the course of orthodontic therapy, with the overjet being eliminated, the lip habit is broken up, buccinator pressures are reduced, and tongue thrust is eliminated by establishing a normal swallowing action. Thus, it is quite reasonable to expand the buccal segments and to expect them to hold. We have very good myographic evidence of a change in muscular function and pressures in these cases. The excellent work of Jarabak[11] at Loyola University and Schlossberg[12] at Northwestern University shows the far-reaching effects of an abnormal swallowing habit. Coincident with such a change, significant dental arch changes can be made. Without such a change, stable results are demonstrable only in immediate posttreatment records, not out-of-retention records. I am not deprecating the role of musculature in orthodontics. On the contrary, I

have the greatest respect for its influence on what we can do. I do feel, however, that unless we change muscle forces and muscle function as we do in the type of case just described, we must adapt our therapy to the limitations of the musculature. We cannot expect the soft tissue draping to give way meekly before our advances. Whenever there is a struggle between muscle and bone, bone always yields.

In most Class I malocclusions, muscle function is within normal limits. Maxillomandibular basal relationships are usually good. Thus, it follows that

Fig. 7.



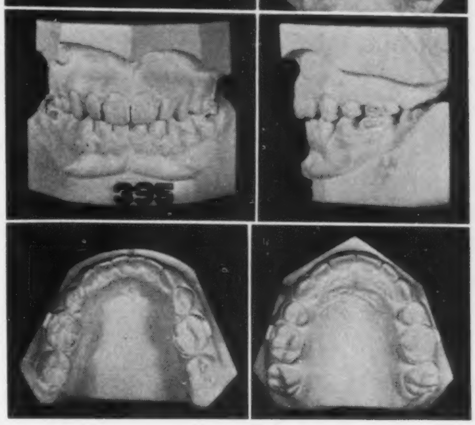


Fig. 8.

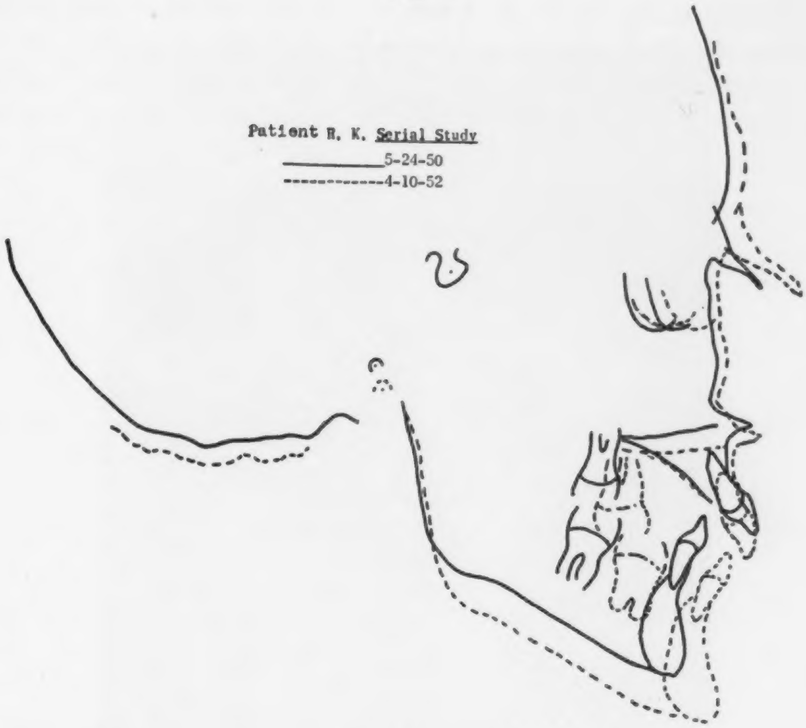
Fig. 7.—Class I malocclusion. The existing tooth alignment represents a compromise between the amount of tooth material and the available basal bone. A state of balance has been established by muscular and functional forces.

Fig. 8.—Case shown in Fig. 7, after orthodontic therapy. Muscular and functional balance has been maintained by maintaining arch form and size and by harmonizing the amount of tooth material with the supporting bone.

if we can expect relatively little help from growth and developmental processes in solving the arch length deficiency problem, and if we need not and do not change muscle function, the inexorable conclusion is to harmonize as nearly as possible the amount of tooth material with the available space and the arch form as determined by the hereditary pattern and the balance of associated tongue, lip, and buccal musculature (Figs. 7 and 8).

The second question concerns Class II malocclusions. The limitations of time and space confine the discussion to Division 1 problems. It is my strong conviction that we are dealing with anteroposterior malrelationships of maxillary and mandibular structures. There is an excessive apical base difference, with the mandibular retrusion as the major factor. Riedel's[13] work at Northwestern University has shown that the position of the maxilla in the face does not vary significantly anteroposteriorly, whether Class I, Class II, or Class III problems be involved. The mandible must assume most of the onus. Class II and Class III malocclusions are problems of pattern, with a strong hereditary predisposition. Ideally, the challenge is to make the mandible grow, to adjust to the apparently normal maxilla (disregarding, of course, local maxillary anterior segment protrusion as a result of perverted muscular function). As I analyze my own results of Class II therapy, I ask myself, "Have my appliance adjustments stimulated mandibular growth?" Can we *make* the mandible grow? Assuming a normal nutritional background and a normal endocrine picture, we apparently cannot make the mandible grow any more with our manipulations than it would grow without them; at least we cannot do this yet. That the future holds some fascinating possibilities cannot be denied. What we can do now however, is to remove any restrictions influencing growth—environmental factors that may prevent the full accomplishment of the inherent pattern. We can and must take advantage of the growth *timing* in our treatment. This last point is the savior of the orthodontist. In his study of growth gradients from the third months to the eighth year of life, in 1940, Brodie[14, 15] concluded that growth was a constant thing, and that growth spurts did not occur. This observation, unfortunately, has been carried over into the late mixed dentition and the permanent dentition periods. This is wrong; there *are* growth spurts! Headplate series after headplate series can be shown, revealing striking growth changes in a short period of time (Figs. 9 and 10). Facial photographs can show dramatic changes, if orthodontic treatment coincides with significant growth increments (Fig. 11). And why should this be so strange? If a boy grows 6 inches in one year skeletally, why should not his mandible, which follows the general bodily growth curve of Scammon,[16] also grow (Fig. 12)? Of course, it does. Puberty has little effect on neural growth, but facial and dental changes in a downward and forward direction can be quite significant. We may not make the mandible grow—Nature does that—but we certainly can take advantage of the growth. If the maxilla and mandible grow at essentially the same rate in a downward and forward direction, and if the major problem is an apical base dysplasia, why not consider restricting maxillary growth or, at the very least, maxillary alveolar growth? The orthopedic surgeon now fits the "good" leg to the clubfoot by mechanical retardation of the normal length extremity. Epiphyses and diaphyses are stapled together during the growing period just long enough to allow the shorter leg to catch up. Using the same philosophy, is it possible to adjust maxillomandibular relationships? It is, but growth or tooth sacrifice, or both, are essential prerequisites. To pit one arch against the other with intermaxillary elastics in the hope of an automatic adjustment, disregarding growth timing

Fig. 9.



	Before Treatment Age 8	After Cervical Treatment Age 10	Extraction of Four Bicuspids Age 12
SNa	78	75	74
SNb	68	66	66
Diff.	10	9	8
NaP	22	18	15
NS-GoGn	39	37	35
$\underline{1}$-NS	105	89	80
$\overline{1}$-$\underline{1}$	116	144	140
$\overline{1}$-GoGn	88	75	85
$\underline{1}$-NP	22mm.	15mm.	11mm

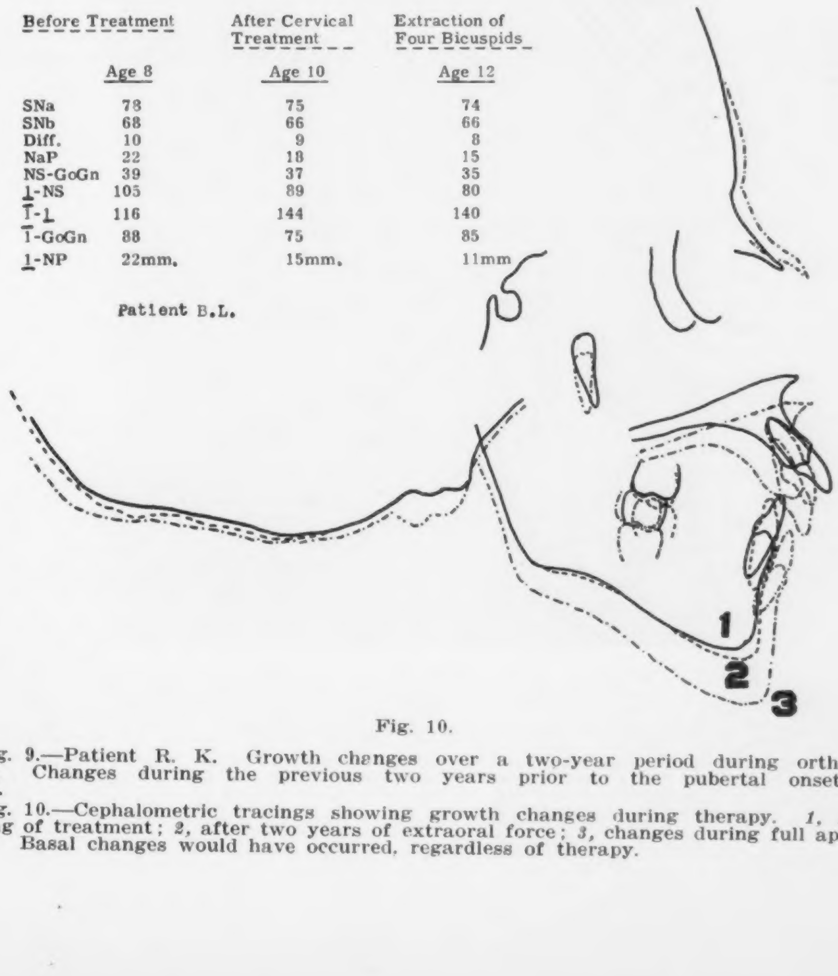


Fig. 10.

Fig. 9.—Patient R. K. Growth changes over a two-year period during orthodontic therapy. Changes during the previous two years prior to the pubertal onset were minimal.

Fig. 10.—Cephalometric tracings showing growth changes during therapy. *1*, At the beginning of treatment; *2*, after two years of extraoral force; *3*, changes during full appliance therapy. Basal changes would have occurred, regardless of therapy.

and increments, is to render a disservice to the patient. Elastic traction has its place and its limitations. Stationary anchorage is a noble theoretical concept; practically, the mandibular teeth either tip forward or slide forward on the base under prolonged elastic attack, regardless of the bracket

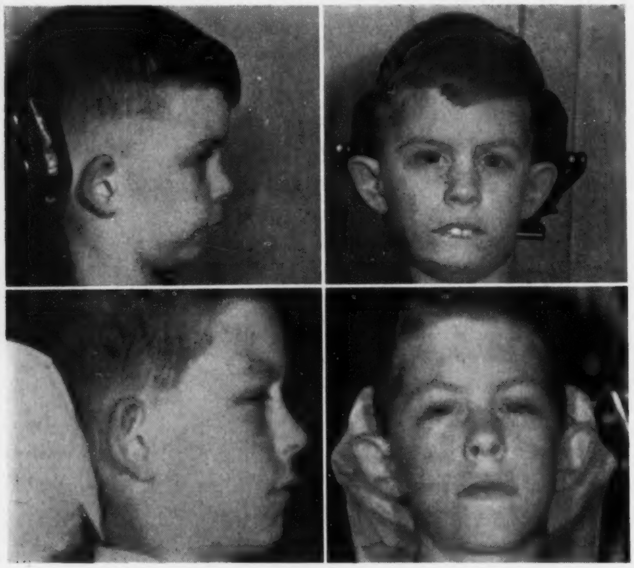


Fig. 11.—Class II, Division 1 malocclusion, before and after therapy. Note significant facial changes as a result of growth and the elimination of functional and muscular perversions.

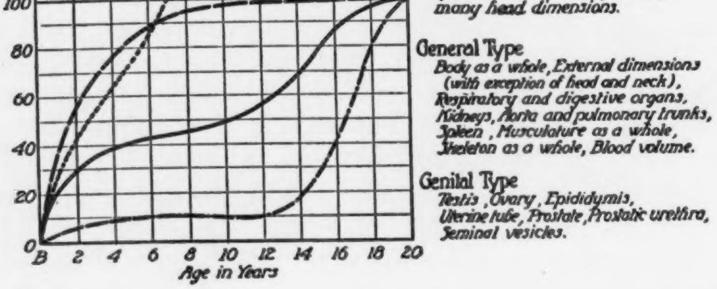


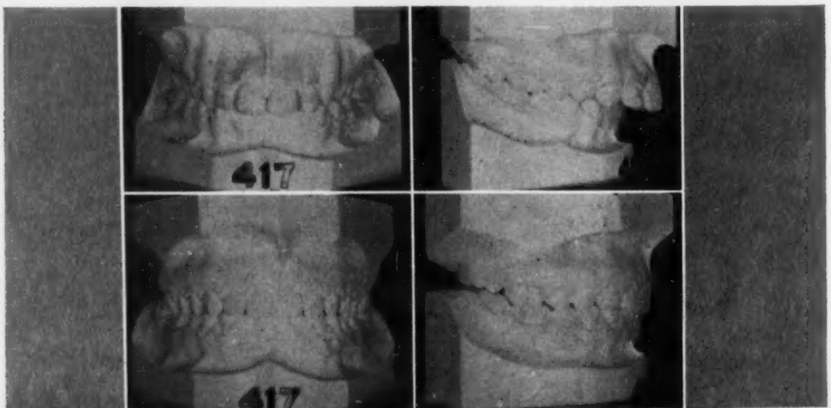
Fig. 12.—Graph illustrating the time and rate of postnatal growth of the major structures and tissues of the body. The several curves are drawn to a common scale by computing their values at successive ages in terms of their total postnatal increments (to 20 years). Note the differential growth rate, particularly of the neural curve, as exemplified by the neurocranium, and the general skeletal curve, which includes certain dimensions of the facial skeleton. It is the general growth curve that reflects the influence of puberty most by acceleration, the lymphoid most by regression. (From Scammon et al.: The Measurement of Man, 1930, University of Minnesota Press.)

Fig. 13.—Patient J. K. Severe Class II, Division 1 malocclusion. Maxillary second molars were removed prior to application of extraoral force against the maxillary arch. *1*, Before treatment; *2*, during retention; *3*, one year out of retention. Note that the erupting maxillary third molars are "taking up the slack" to assume the position of the missing second molars.

attachment and regardless of whether the arch wire is rectangular, square, tapering, ovoid, or what-have-you. Good growth increments reduce this tendency. Functional retrusion may exist, and its elimination may help a bit, but the basic reciprocal response to intermaxillary force exists.

In the maxillary arch, only so much room exists in the alveolar trough for distal movement of teeth. After this has been gained, further movement is at the expense of impacting second and third molars, or causing

Fig. 14.



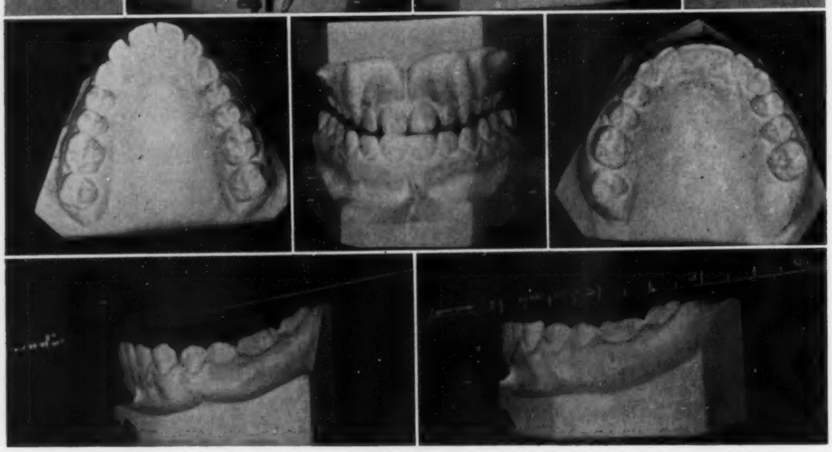


Fig. 15.

Fig. 14.—Patient J. K. Casts taken before treatment and after retention. Observe the overbite correction and erupting maxillary third molars.

Fig. 15.—Patient J. K. Comparison of maxillary and mandibular casts. Examination of maxillary casts taken before and after treatment shows change in arch form with an increase in buccal segment width. The excessive curve of Spee has been reduced and the incisors uprighted some in the mandibular arch, despite the fact that the only appliance worn was a maxillary labial arch and first molar bands, plus a removable bite plate.

them to erupt buccally. There is not one whit of evidence that orthodontic appliances stimulate bony apposition on the tuberosity in advance of tooth movement. There are several qualifying elements affecting the success of distal movement in the maxilla. These are the amount of distal movement needed, the available alveolar trough space, the presence or absence of

third molars, the differential size of deciduous molars and their successors (the premolars), growth increments during treatment, and the length and intensity of intermaxillary force.

Class II therapy, then, *does not* mean simple reciprocal force—maxilla against mandible. It *does* mean, first, removing all interferences that might restrict complete accomplishment of mandibular pattern growth (excessive overbite, for example). Second, it means restriction of the forward component of maxillary or maxillary alveolar process growth to reduce the basal dysplasia and allow unimpeded mandibular growth.[17] Third, it means taking up the alveolar trough slack. How much of each element is needed depends on mandibular growth increments, on treatment timing, and on the length of treatment. If growth increments are small during therapy, more recourse must be had to distal movement of the maxillary denture either by taking up available space or by creating space, but most certainly not by dragging the mandibular denture froward with elastics. This may mean extraction of the maxillary first premolars, second premolars, or second molars. The last alternative offers a most attractive possibility, as shown by Figs. 13, 14 and 15.[18]

APPLIANCES

The balance of the discussion will deal with appliances, albeit still in a semiphilosophical vein. Dr. Fred Noyes has recounted to me many anecdotes

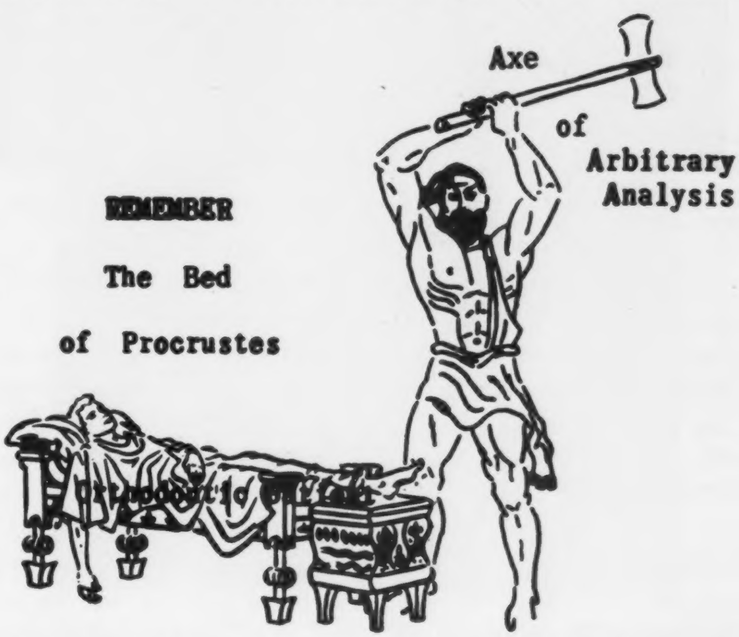


Fig. 16.—In some instances, there has been a tendency to make the patient fit the demands and limitations of the appliance, either by tooth sacrifice or lack of tooth sacrifice. The patient's problem is primary; the armamentarium exists as subservient to that problem.

from his rich and rewarding friendship with Edward H. Angle. One of his favorite aphorisms, frequently repeated and embellished by choice descriptive adjectives as only Dr. Angle could do in his own gruff way, was:

"All you can do is push a tooth, pull it, or twist it. I have given you an appliance to do that. Now, for God's sake, use it!" Indeed, Angle gave us several appliances, and other orthodontists have done likewise. Firmly entrenched in my appliance thinking is the conviction that there is no one single appliance. All too often, in the past, we have attributed our success to a particular mechanical approach or gadget, when success may well have been a symbiotic consequence of concomitant growth, proper treatment timing, use of available alveolar trough space, and/or patient cooperation. We cannot, we must not, emulate Procrustes, the innkeeper fitting all our cases into the same mechanical strait jacket (Fig. 16). Certain appliances are better equipped for certain tasks; here there is no argument. But it is just as much an error to use twenty horses to pull a cart across the stream as it is to use four, when, in reality, eight or nine or ten are needed, or when perhaps even some outside assistance may be required. It already has been

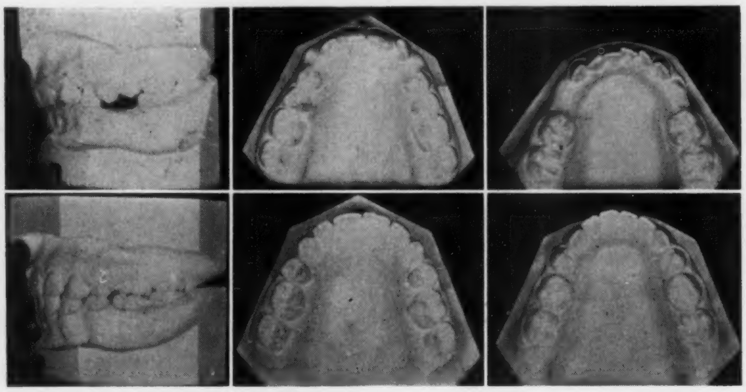


Fig. 17.—Patient J. L. Class II malocclusion. Initial problems of deep overbite, arch length deficiency, and lingually inclined incisors impose difficult mechanotherapy demands.

strongly emphasized that most Class I malocclusions with arch deficiency problems cannot be resolved by expansion—that we must either accept the pattern irregularity (which may well be a good decision) or we must remove teeth to harmonize the amount of tooth material with the available basal bone. If we remove teeth, our appliance must be adequate to produce the desired bodily movement demanded by tooth sacrifice and the ultimate stability of the results. Several attachments are capable of "doing the job," if used properly. *Properly* does not necessarily mean as the originator of the attachment initially prescribed, either. I happen to use twin edgewise bracket attachments, but I readily concede that this appliance has undergone quite a metamorphosis in its development, from the "perfect nonextraction appliance" to the "perfect extraction appliance." No appliance is perfect and claims will not make it so, but some attachments are better qualified, in most operators' hands, to do the job more simply and surely. We must be on the constant lookout for the tendency to let the limitations of the appliance rationalize our philosophy of treatment. Many, many extraction cases today become expansion cases because of underpowered mechanics. There are no

automatic appliances. All too many patients are subjected to the needless removal of four premolars because the operator has learned a Tweed technique, a Bull technique, or a Strang technique without learning the discretionary elements of such a technique.

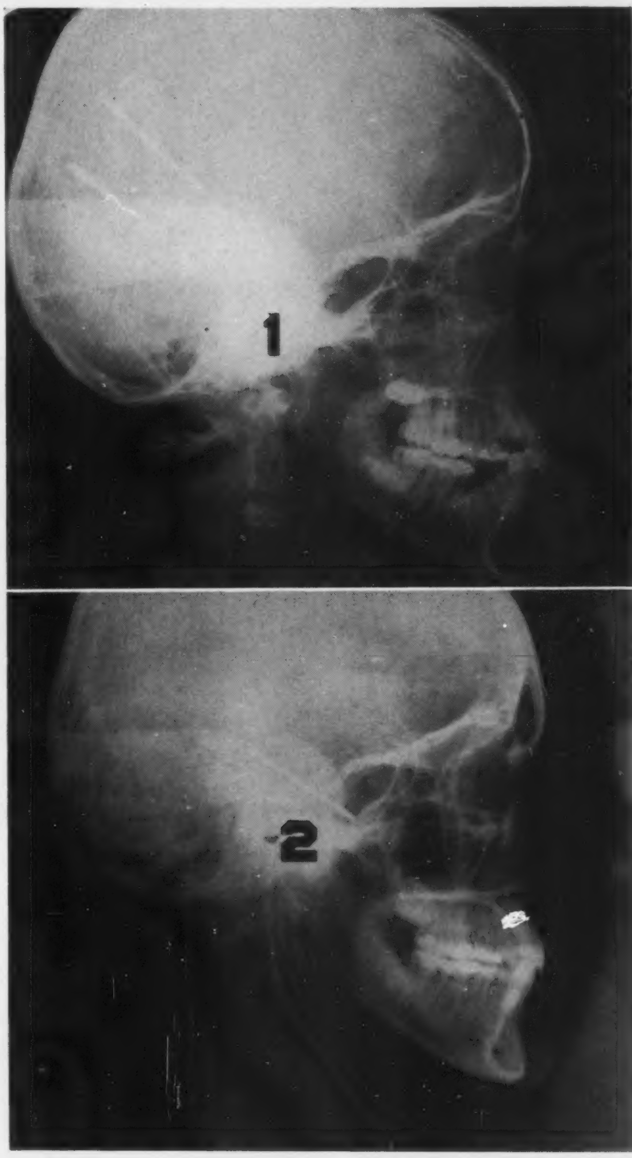


Fig. 18.—Patient J. L. Cephalometric radiographs before and after orthodontic treatment. Four first premolars were removed and full appliances used. Note change in incisor inclination by lingual root torque—so necessary to insure a stable result with a minimum of relapsing overbite.

In Class II therapy, my philosophy demands the minimum of intermaxillary force. Exceptions are those Class II cases, with not too severe overbite and overjet problems, in which arch length is deficient in the lower arch particularly and recourse is made to extraction (Figs. 17 and 18). My

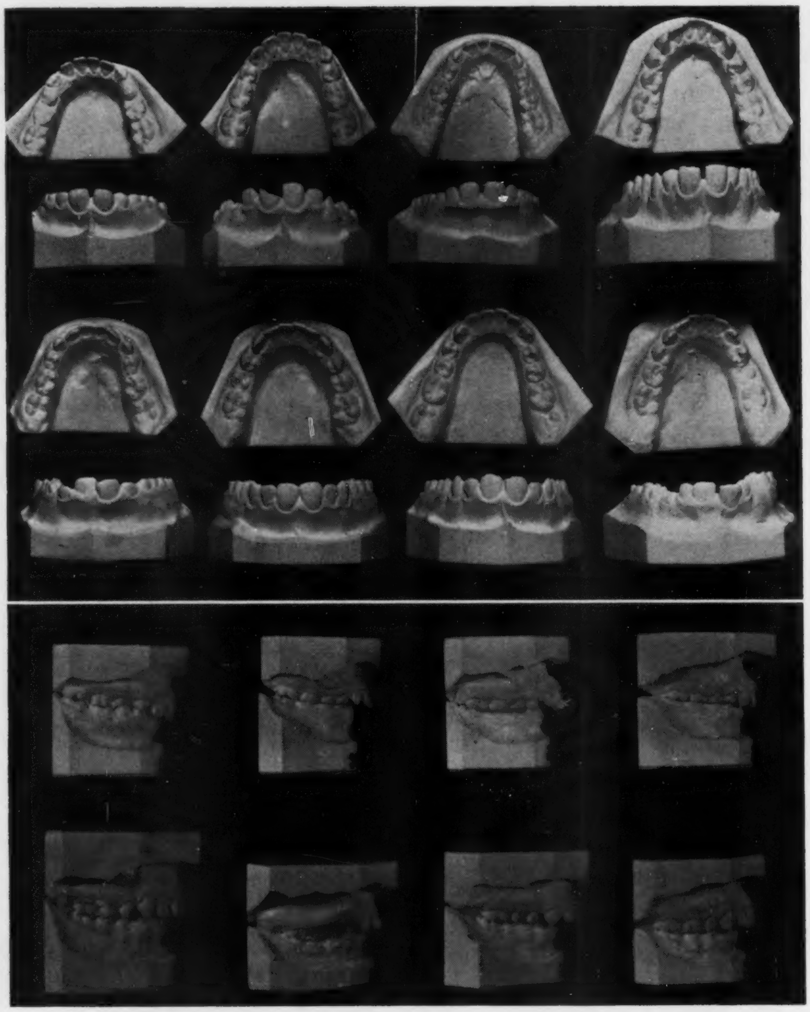


Fig. 19.—Class II, Division 1 malocclusion cases. The arch form is essentially normal in the mandibular arch. The malocclusion is apparent only when maxillary and mandibular casts are articulated. (From Graber: AM. J. ORTHODONTICS, July, 1955.)

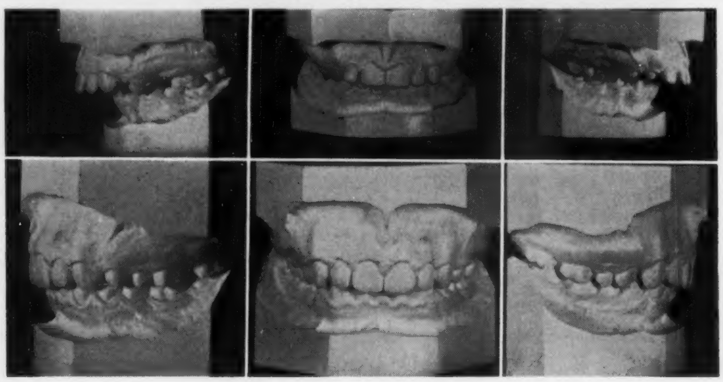


Fig. 20.—Patient P. O. Severe Class II, Division 1 malocclusion, complicated by complete maxillary buccal cross-bite. Simplicity of therapy (extraoral force and bite plate only) was possible because of proper treatment timing and significant growth increments.

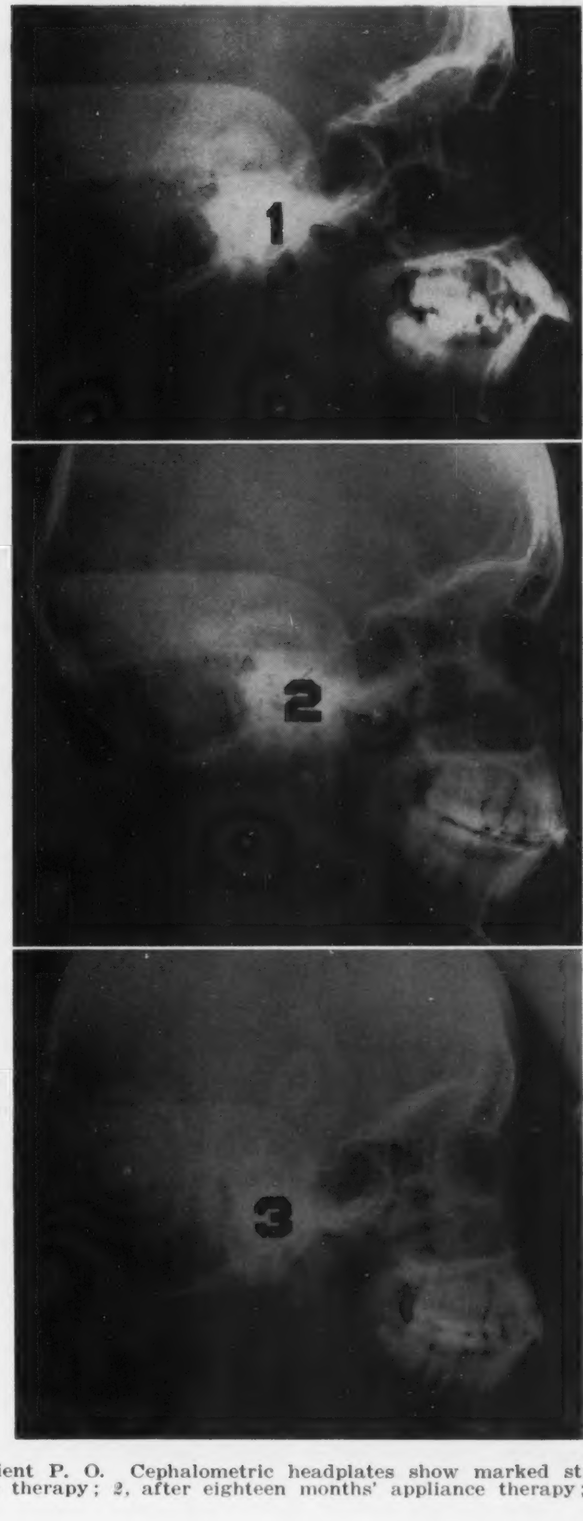


Fig. 21.—Patient P. O. Cephalometric headplates show marked structural relationship change. *1*, Before therapy; *2*, after eighteen months' appliance therapy; *3*, after completion of treatment.

constant concern in these cases, or in any Class II case with extraction in the lower arch, is relapsing overbite. Usually, my worst fears are justified. Thus, I am quite willing to accept a moderate irregularity in the mandibular anterior segment in preference to regularity at the time appliances are removed, but a regularity gained at the expense of tooth removal with its greater attendant future functional and periodontal implications. A large portion of Class II cases show essentially normal mandibular arches, if examined unrelated to the maxillary arch. Only when the upper and lower casts are articulated is the malocclusion fully apparent (Fig. 19). I cannot bring myself to disturb tooth-to-basal-bone relationships in these cases, except as a last resort. Thus, extraoral appliances and bite plates make up a large part of my armamentarium for Class II, Division 1 malocclusions. Intermaxillary elastics are used part-time in some cases, but no more than half-time, and usually the damage to the integrity of the mandibular dental arch is minimal. I can think of as many limitations of extraoral appliances as any other operator—strong dependence on patient cooperation, intermittent wear, all-too-frequent unilateral response, inability to eliminate excessive curve of Spee in many cases, tendency for maxillary first molars to tip excessively distal, sometimes impacting second molars, and excessive lingual inclination of the maxillary incisors in some cases. Despite all these occasional hazards, however, I could not conscientiously treat Class II, Division 1 malocclusions without extraoral force, and Class II cases make up two-thirds of the total number of cases that I treat. As I critically examine my results, I deplore those instances in which the therapeutic results fell short of the treatment goal, but I am not convinced that handling the case differently would guarantee success. Nor am I sure that cases like those shown in Figs. 20 and 21 would not have turned out less well if treated by a method in which the steps of treatment were dictated by an appliance instead of by the patient's problem, his age, his growth expectancy, his tissue health picture, etc.

Thus, the challenge to me, and to you if you agree with me, is to maintain a sufficiently broad philosophy of treatment to cover all cases. I must fight constantly the regimentation of my thinking and my tendency to categorize and treat by groups instead of treating the individual patient. I must search constantly for the contributions to be expected from the individual patient's inherent pattern, from general health, from endocrine balance, from growth and development, from treatment timing and length of appliance wear, from the role of muscular function and habits, from the available alveolar trough space, from the possibility of tooth sacrifice, indeed from many things that broaden the horizon and, in so doing, make orthodontics the fascinating field that it is today. I could do no better than finish with a quotation from Andrew Francis Jackson[19]:

> In its broad comprehensive aspect, orthodontic practice actually consists of bold and audacious attempts to alter the entire natural genetic and functional patterns of certain specific, unique, infinitely variable, scientifically incalculable and unpredictable human individuals. These changes include their teeth, bones, temporomandibular joints, and esthetic facial proportions. To be more specific, the factors involved include the whole

gamut of heredity and environment, the infinite variations and combinations of anatomic proportions, physiologic functions, psychologic motivations and habits, diseases, endocrine unbalances, traumatic injuries, mutilations and gross abnormalities. The resultant composite combinations which all these factors, with their infinite variations, are capable of producing must be appraised and balanced by the would-be orthodontist into single, all-inclusive, specific and individual mental pictures and, when judged "unsatisfactory," altered by natural and artificial means into other specific, unique, all-inclusive, three-dimensional arrangements which will remain in satisfactory and stable conditions of structural, functional and esthetic equilibrium. This is orthodontics, and there is nothing in "the heavens above or the earth beneath or the waters under the earth" that can make it anything different or simpler.

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Editorial

BASIC ETIOLOGICAL FACTORS IN DENTOFACIAL MALFORMATIONS

ORTHODONTISTS too long have confused classification of malocclusion with etiology. While classification of malocclusion (whether according to Angle or by cephalometrics) is important, an understanding of actual etiological factors is a prime requisite in determining prognosis and in the prevention of dentofacial deformities. What we see in our clinical and x-ray examinations are the end results of etiological factors. The etiological factors themselves are frequently to be found elsewhere.

Experiments currently being conducted in the intrauterine environment of embryos indicate the etiology in the production, possible modification, and even elimination of certain malformations. Experimental embryology deals with the phenotypical development of genotypes in a changing environment. Regarding the relative importance of heredity as opposed to environment, Bronsted,* professor of general zoology at the University of Copenhagen, points out that living matter cannot exist apart from environment. The genotype is actually an abstract because, from the moment of fertilization of the ovum, all chemical processes are interrelated with environment. Although genetics concerns itself basically with the genotype, it can be studied only as it expresses itself in the phenotype. By altering the environment, the normal genotypical path of intrauterine development can also be altered.

Spemann** found that some of the cells in the very young embryo can be influenced to function in an abnormal manner, depending on changes in the environment. This fact presents a basic clue to the understanding of the manner in which malformations are produced.

It is not always easy, as orthodontists are aware, to determine what is normal and what is a malformation or a deviation from the norm. This is especially true since nature favors diversity. In the case of dental occlusion, we have accepted for our purpose a basic human pattern or formula of occlusion. The expression of this pattern in the individual person is far from uniform and attempts to make it uniform, as orthodontists have found to their dismay, are not always successful.

There are three stages in the manifestation of the growth pattern: (1) genotypical, (2) fetal environmental, and (3) postnatal environmental. Cell

*Bronsted, H. V.: Warning and promise of Experimental Embroyology, Impact 6: 183-208, 1955.

**Spemann, Hans: Embryonic Development and Induction, New Haven, 1938, Yale University Press.

division and differentiation are genotypically determined, but they are influenced by intrauterine environment.

Experimental embryology indicated that, whereas the genotype determines whether a total malformation will be present, environment, in addition to being responsible for malformations, also determines the severity with which malformations of genetic origin will manifest themselves. It is important to establish criteria for differentiating between malformations of purely genetic origin and those caused by unfavorable environment.

Vitamin deficiencies in the mother are among the intrauterine environmental factors responsible for congenital malformations. A large variety of malformations have been found in the newborn children of mothers with severe vitamin A deficiency. If vitamin A is administered early enough in relation to the determination of a given organ, the development of the organ is normal. Deficiency of riboflavin has been found to result in shortening of the mandible, cleft palate, and other skeletal malformations in rats. Administration of riboflavin to the pregnant rat before certain organs began to form was found to prevent malformations in these organs.

The lack of certain trace elements in food is known to produce growth and development disturbances. Iodine deficiency causes cretinism, and the degree of cretinism is correlated to the extent of iodine deficiency in the mother's diet. Chemicals used in preserving food should be watched for deleterious effects on the fetus. Dietary deficiencies vary and the deformities thus produced also vary. It is important for pregnant women to be well vitaminized.

Radiation is a known cause of deformity in newborn children. Animal experiments indicate that malformed newborn offspring can be produced by a dose as low as 25 roentgens. Many fluoroscope machines emit more than 30 r per minute. The use of therapeutic x-ray is an even greater potential danger. Among the malformations following the use of x-ray are cleft palate, mongolism, micro- and hydrocephaly, and deformed limbs. The most critical stage in the human fetus when malformations can occur is the first six weeks of the first trimester of pregnancy. The pregnant woman may not be aware that she is pregnant when organogenesis begins. The fetus may be damaged by even small doses of x-ray or fluoroscopy, and malformations may show themselves later in the life of the offspring.

The initial report of the National Academy of Sciences on "The Biological Effects of Atomic Radiation" warns that Americans are using up about one-third of their atomic radiation safety limit in medical and dental x-rays. Physicians and dentists are asked to reduce the use of x-rays to the lowest frequency.

Genetic scientists state that medical and dental x-rays are storing up dangers which may show themselves in genetic mutations and malformations in generations yet unborn. Dentists, especially orthodontists, would do well to investigate the roentgen dose to which they expose their patients as well as themselves.

The report on children borne by women who experienced the Nagasaki and Hiroshima bombings indicates the harm resulting from radiation. In the hypocenter, an area 2 kilometers in diameter directly beneath the point of explosion, there were 98 pregnant women. Twenty-eight of their fetuses died before birth. Of 113 pregnant women outside the hypocenter, only 2.6 per cent of the fetuses died prior to normal birth. The death rate was greatest among the fetuses which had not completed the first trimester when the explosion occurred. Body length of surviving children of mothers who were heavily exposed to the radiation was 3 cm. shorter, on an average, than normal and 2 kilograms less in weight five years after the bombing. Head circumference was 2 to 3 cm. less than normal.

Endocrine imbalances are known to cause disturbances in the growth and development pattern. Large doses of hormones given to pregnant rats are found to produce cleft palate and other malformations.

Rubella in pregnant women is accepted as an important factor in causing malformation in the fetus, especially if the rubella occurs in the first two months of pregnancy. It is believed that certain chemical poisons get through the placental wall and affect the embryo.

Since malformations can be produced in the fetus by unfavorable environmental conditions, it stands to reason that we should also be able to obviate malformations by favorably influencing fetal environment. How this can be accomplished still requires a great deal of research.

For the past quarter of a century or more, orthodontists have given much thought to cephalometrics which, in its final analysis, is a method of defining and classifying malocclusion as found in the individual patient, in addition to its value in comparative growth studies. We should also continue to seek etiological factors in addition to classification and description of malocclusion. Greater knowledge and understanding of etiology are important, not only to successful treatment but also in the prevention of maxillo-dento-facial deformities.

J. A. S.

Department of Orthodontic Abstracts and Reviews

Edited by

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All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Applied Orthodontics. By James David McCoy, M.S., D.D.S., F.A.C.D., and Earl Emanuel Shepard, D.D.S., F.A.C.D. Seventh edition. 336 pages with 212 illustrations and 9 plates. Price $7.50. Published by Lea & Febiger, Philadelphia.

The preface of the seventh edition of *Applied Orthodontics*, among other things, has this to say:

> "It is hoped that the seventh edition will stimulate those of its readers who have a real interest in orthodontics to seek out those additional sources of information, to the end that they will have a complete picture of all the problems relating to the field of dentofacial orthopedics."

The above quotation reveals much of the theme of the seventh edition of *Applied Orthodontics*.

This edition is profusely illustrated and contains 212 engravings and 9 plates. It is obvious that an effort has been made to arrange the illustrations so that they will lend themselves to teaching purposes. Some of the illustrations appeared in the previous editions but many of them are entirely new and original and add much to the reader interest of the book.

This late edition is a new version of a textbook well known to the practice and teaching of orthodontics. The authors maintained a tremendous interest in presenting the basic principles of tooth movement, and that theme continues in the new edition.

The subject of appliances is treated in a general way, with emphasis on fundamental principles rather than upon the detailed technical description of any individual appliance or so-called system. Notwithstanding, details of appliance fabrication are not ignored, and there are numerous descriptions of cases that have been treated by the McCoy technique. The problems of diagnosis and the discussion of tissue changes during tooth movement are sensibly handled by authors of tremendous background and experience.

The book can be recommended for both undergraduate and graduate orthodontic students, notwithstanding its contents and general theme reflect the many years of experience of a capable orthodontist along with the talents of Dr. Shepard, who is presently engaged in teaching orthodontics at Washington University in St. Louis, Missouri.

The book should be a valuable addition to the library of every orthodontist and of every school interested in the subject.

Practical Orthodontics. By George M. Anderson. Eighth edition. St. Louis, The C. V. Mosby Company, 1955. Price $17.50.

It is an honor to be asked to review the eighth edition of Dr. George Anderson's *Practical Orthodontics.* This book starts out with two very important factors in its favor. The fact that this is the eighth edition is evidence of the wide popularity and merit of the former editions. Dr. Anderson's, being recognized as one of the top-ranking clinical orthodontists of the country is sufficient guarantee that in this latest, revised edition he has included all the material which the best minds in orthodontics consider most useful and practical for the successful treatment of cases as understood in these United States of North America.

There are several avenues of approach to writing a book on orthodontics, depending on the purposes and motivations of the author. These will usually narrow down to one of two main avenues of approach. The choice will depend on the natural bent of the author's own interest in the subject and the nature of his own personal talents for the undertaking.

In orthodontics there are several anthologies on the subject in which the authors have included practically every concept and system of technique that has been devised to date, but in which the authors themselves have refrained from expressing opinions of their own.

On the other hand, several books have been devoted to just one specific concept and system of technical therapy, ignoring other systems that are diametrically different.

This has produced, among other more complex factors, a state of confusion which is bewildering to the beginner but which lends itself to some extremely interesting studies in an analysis of the reasons for this state of affairs.

It is pretty well known that the critical and creative faculties are seldom found in the same individual. Fortunately, Dr. Anderson is an exception to this rule.

In this eighth edition of *Practical Orthodontics,* Dr. Anderson has done a good job in accordance with the first of the two formulas, and has succeeded in condensing in one volume, and with excellent judgment, most of the important, and particularly the practical, material which should be included in a book of this kind. The bibliography which has been covered is so encyclopedic in its scope that it creates in the reader a feeling of genuine admiration for the labor alone which has been entailed in its preparation. Naturally, it is impossible to include everything and please everybody, and Dr. Anderson has already been taken to task for not including material which has found favor especially with some foreign orthodontists.

The book is, in effect, a symposium without suggestions on the part of the author as to how the many conflicting ideologies may be reconciled to the hidden fundamental truth which underlies them all, and to which each of them may have contributed a few scattered grains. Aristotle has said, "While individually we contribute little or nothing to the truth, by the union of all a considerable amount is amassed."

To the experienced orthodontist, the book is of great value as a work or reference in that, figuratively speaking, Dr. Anderson has, in convenient form, reduced from a mountainous volume of crude ore a few tons of well-selected high-grade material with which to work.

As a textbook for the student or beginner, the book should have a salutary effect of impressing, if not awing, the novice with the extreme complexity of orthodontics if looked upon from the purely scientific aspect. What should not be forgotten is that orthodontics is much more than an applied science and that some of the most difficult skills in life are acquired by methods in which

the scientific background plays only a small and inadequate part, but must be supplemented by logic and common sense and a vast amount of practical experience, together with an innate and highly developed artistic sense.

For the teacher of orthodontics, the book contains a vast fund of valuable information and material, sufficient to cover several times the amount of time allotted to him for his lecture periods. The task of reducing this still further to a clear, concise concept of the nature of orthodontics, methods of evaluating the invariably unique problems which present themselves in practice, under a set of nonconflicting "principles of universal application" which are in harmony with the techniques to be employed in treatment, still lies before the man who enjoys the faculty of using his own mind. The perfect book on orthodontics may never be written. In the meantime, Dr. Anderson's book is practically a necessity for every thinking orthodontist.

Andrew F. Jackson.

News and Notes

American Association of Orthodontists 1957 Annual Meeting

Bourbon Street, New Orleans

Just across Canal Street and within four blocks of the Roosevelt, headquarters hotel of next year's annual meeting, is Bourbon Street, a quaint, narrow thoroughfare on and around which are located many of New Orleans' famous French restaurants.

Bourbon Street in New Orleans.

Many antique and curio shops are located in this area and are a delight to the window shopper.

Much of the night life of New Orleans is centered along Bourbon Street, in night clubs featuring Dixieland jazz which had its birth in this city.

Seen here is the bus named Desire, which recently replaced the streetcar of that name.

The old building on the left is the famous Absinthe House. The building was erected in 1806 as a combination residence and business establishment and later became known as the Absinthe House because of the absinthe frappé served there.

Plan now to attend the next meeting of your Association, May 12 to 16, 1957, in New Orleans, the city you'll never forget.

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Roosevelt Hotel in New Orleans, Louisiana, May 7 through 11, 1957. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Dr. Wendell L. Wylie, University of California, School of Dentistry, San Francisco 22, California.

Applications for acceptance at the New Orleans meeting, leading to stipulation of examination requirement for the following year, must be filed before March 1, 1957. To be eligible, an applicant must have been an active member of the American Association of Orthodontists for at least two years.

A.B.O. Theses Available for Reading on Constituent Society Programs

Reading of A.B.O. theses by diplomates before constituent societies has been disallowed for the past several years. This stand was taken because of serious abuses encountered.

Year after year, desire for use of these theses by constituent societies had increased to the point where the American Board of Orthodontics undertook a serious attempt to make some of them available, while at the same time protecting our profession by enactment of rigid controls aimed at prohibiting the abuses.

In 1953 the Board created a pool of theses available for reading before constituent societies, should they be desired. At the present time twenty-eight theses are in this pool, from the 1954, 1955, and 1956 examinations.

Rules for using these theses are as follows:

1. Permission for inclusion on programs must be requested by the secretary of the constituent society in writing and filed with the secretary of the American Board of Orthodontics.
2. The constituent societies must not offer the paper for publication in any journal without express written permission from the Board.
3. Should permission be given for publication, no reprints will be permitted under any circumstances.
4. The author of the thesis is required to announce that the paper was part of his A.B.O. requirements, that the Board has granted permission for the presentation, and that such permission does not necessarily imply that the Board is in agreement with the concepts expressed in the thesis.

CONSTITUENT SOCIETY POOL OF THESES
1956-1957

Author	*Title*
Richard A. Riedel.	An Analysis of Dentofacial Relationships.
Everett Shapiro.	Current Concepts and Clinical Applications of the Edgewise Arch Mechanism.
Arnold W. Wieser.	Orthodontic Treatment of Adult Dentition.

1957 Albert H. Ketcham Memorial Award

It has just been learned from the committee in charge that Oren A. Oliver, D.D.S., LL.D., will be the recipient of the Albert H. Ketcham Memorial Award for 1957.

Central Section of the American Association of Orthodontists

The current *News Letter* of the Central Section of the American Association of Orthodontists reveals that the nineteenth annual session of the current section will be held at the Edgewater Beach Hotel in Chicago on Oct. 1 and 2, 1956. The program is as follows:

Essayists	*Title*
1. William B. Downs, Aurora, Illinois.	Morphology of Facial Patterns.
2. E. H. Hixon, Iowa City, Iowa.	Some Uses and Abuses of Norms in Case Analysis and Treatment Planning.
3. Ashley E. Howes, New Rochelle, New York.	Arch Width in the Biscuspid Region Still the Major Problem in Orthodontics.
4. Earl W. Renfroe, Chicago, Illinois.	The Factor of Stabilization in Anchorage.
5. John R. Thompson, Chicago, Illinois.	Form and Function in Orthodontics.
6. Gustav Korkhaus, Bonn, Germany.	Present Orthodontic Thought in Germany.

Case Reports

1. Ben L. Herzberg, Chicago, Illinois.
2. Frank C. Jefferies, Des Moines, Iowa.
3. Frank S. Ryan, Aurora, Illinois.
4. Earl E. Shepard, St. Louis, Missouri.
5. Karl E. von der Heydt, Glen Ellyn, Illinois.

LAST ANNUAL MEETING BRIEFS

At the last annual meeting of the Central Section of the American Association of Orthodontists held at the Savery Hotel in Des Moines, Iowa, October 3 and 4, the following new officers were installed:

President	Richard A. Smith, Evanston, Illinois.
President-Elect	Thomas D. Speidel, Minneapolis, Minnesota.
Vice-President	Frederick B. Lehman, Cedar Rapids, Iowa.
Secretary-Treasurer	William F. Ford, Winnetka, Illinois.
Representative to the Board of Directors of the A.A.O.	P. M. Dunn, Minneapolis, Minnesota.
Alternate	Ralph G. Bengston, Chicago, Illinois.
Section Editor	Charles R. Baker, Evanston, Illinois.
New Member to the Board of Censors	James S. Hoffer, Des Moines, Iowa.
New Member to the Publications Board	David Thompson, Elmhurst, Illinois.
New Member to the Judicial Board	Henry Colby, Minneapolis, Minnesota.

Great Lakes Society of Orthodontists

The twenty-seventh annual meeting of the Great Lakes Society of Orthodontists will be held at the Chateau Laurier in Ottawa, Ontario, Canada, Oct. 7 through 10, 1956.

Middle Atlantic Society of Orthodontists

The annual meeting of the Middle Atlantic Society of Orthodontists will be held Oct. 14, 15, and 16, 1956, at Haddon Hall, Atlantic City, New Jersey. T. M. Graber, Chicago, Illinois, B. F. Dewel, Evanston, Illinois, and Harlan Shehan, Jackson, Michigan, will take over the scientific program. Daniel E. Shehan of Baltimore, Maryland, is president.

Northeastern Society of Orthodontists

The fall meeting of the Northeastern Society of Orthodontists will be held in Hartford, Connecticut, Monday and Tuesday, Oct. 29 and 30, 1956, at the Hotel Statler.

Pacific Coast Society of Orthodontists

The 1956 annual meeting was held in Seattle, Washington, August 13 through 15 at the Benjamin Franklin Hotel.

SOUTHERN COMPONENT

The regular meeting was held on June 8 and was called to order by Chairman Cal Garverick at the Huntington Sheraton Hotel.

Program Chairman Eldor Sagehorn introduced Rod Mathews, who spoke on "Problems of Early Treatment of Mixed Dentition Cases."

The minutes of the previous meeting were approved as published in the *Bulletin*.

C. Menzies Clark, Edward A. Kemler, Milo M. Stucky, Clarence D. Honig, R. Morley Davis, and V. Dovitch were approved as associate members.

Correspondence was read from P.C.S.O. secretary, Ray Curtner, to Rear Admiral Ryan initiating steps correcting the interpretation of a directive necessitating the removal of orthodontic appliances previous to a Naval dental examination.

Sydney Cross read correspondence from Keeling and Company regarding (1) service inductees involved with orthodontic problems and (2) cases involving nonpayment of fees.

After the social hour and dinner, the speaker of the evening was William Paden, who presented his appliance techniques for "The Early Treatment of Mixed Dentition Cases."

NORTHERN COMPONENT

No meeting.

CENTRAL COMPONENT

Our component held its regular meeting on Tuesday, July 12 at Panelli's Restaurant in San Francisco, California.

The program consisted of an informal panel discussion on "Retention and Its Problems." Program Chairman Oliver Hartman introduced William A. Elsasser, who acted as moderator. Robert B. Murray discussed the positioner, Walter J. Straub discussed the retainer, and Raymond M. Curtner discussed activated appliances used during the retention period. After each panelist made a preliminary statement of the problem, questions from the group were discussed.

Rocky Mountain Society of Orthodontists

The thirty-sixth annual meeting of the Rocky Mountain Society of Orthodontists will be held Oct. 1 and 2, 1956, at the Bishop's Lodge, Santa Fe, New Mexico.

This will be the Society's first meeting outside Denver, and we believe that it will be one of our best.

The guest lecturers and clinicians will include:

J. William Adams, Chairman of the Department of Orthodontics, Indiana University.

(1) Retention—the Least Scientific Phase of Orthodontia.
(2) The Treatment of the Mixed Denture Class II, Division 1.
(3) Important Differences Between the New and Old Schools of Orthodontia—The Impact on People.

Samuel Pruzansky, Cleft Palate Program.

(1) Muscle and Muscles.
(2) Electromyography in the Analysis of Occlusion.

(3) Rationale for Orthodontic Treatment of Cleft Palate in the Deciduous Dentition.

(4) The Results of a Seven-Year Longitudinal Growth Study of Infants With Cleft Lip and Palate.

We are most grateful to the Albuquerque group—Drs. King, Blueher, and Brown—for making all the local arrangements.

HOWARD L. WILSON
Secretary-Treasurer.

George M. Anderson Receives Honorary Degree

The following are the remarks made by President Wilson H. Elkins of the University of Maryland, in conferring an honorary degree on Dr. George M. Anderson, well-known Baltimore orthodontist.

George M. Anderson receiving honorary degree.

Mr. President: I am honored to present to you Dr. George McCullough Anderson, a native Marylander and a graduate with first honors of the Baltimore College of Dental Surgery in the year 1919.

From 1919 to 1926 he served as instructor in orthodontics, and in 1926 he was appointed Professor of Orthodontics, a position he held until 1948.

He is a past president of the Baltimore City Dental Society, Maryland State Dental Association, Middle Atlantic Society of Orthodontists, National Alumni Association of the Baltimore College of Dental Surgery. He is an honorary member of the Mexican Orthodontic Society and a Fellow of the American College of Dentists.

He is certified by the American Board of Orthodontics and is a member of Omicron Kappa Upsilon, the honorary dental society. He served on the Maryland State Planning Commission, 1951-55, and the Maryland State Board of Health since 1935.

He is the author of two standard textbooks on his specialty, and was Chairman of the Scientific Sessions and Editor of the Proceedings of the Dental Centenary Celebration, 1940.

He has contributed to dental research, lectured before many dental societies, and published many articles on his specialty.

Dr. Anderson is the recipient of the First Distinguished Alumni Award, 1956, granted by his colleagues of the National Alumni Association of the Baltimore College of Dental Surgery, Dental School, University of Maryland.

Because of his many contributions to his community and to the great triad of dentistry —dental organization, dental literature, and dental education—it gives me great pleasure to present this candidate for the degree of Doctor of Science, *honoris causa*.

Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will meet Oct. 7 to 10, 1956, at the Shamrock-Hilton Hotel in Houston, Texas.

American Institute of Dental Medicine

The next annual meeting of the American Institute of Dental Medicine will take place at El Mirador, Palm Springs, California, Nov. 4 to 8, 1956. The essayists will be Drs. Francis L. Chamberlain, Milton B. Engel, Donald A. Kerr, Helmut A. Zander, and S. I. Hayakawa.

Applications and full information may be secured from the executive secretary, Miss Marion G. Lewis, 2240 Channing Way, Berkeley 4, California.

Oklahoma State Orthodontic Society

The orthodontists of Oklahoma have been enjoying the benefits of their rather informal get-together meetings since they organized as a group some five years ago. Since the programs of the American Association of Orthodontists, the Southwestern Society of Orthodontists, and other study groups very largely feature the scientific and technical aspects of orthodontics, the Oklahoma group felt that a study of situations surrounding an orthodontist's life would be advantageous. We thought that whatever is good for an orthodontist personally and in general contributes to his welfare and morale and helps him to render a better service very well could be our goal. Facing the facts of life (the problems that surround the orthodontist's life) would be the approach. The more he is freed from the worries, frustrations, and complexities of life, the more he has to offer in other channels; for instance, the welfare of his practice. We regard it a challenge to delve into certain phases of the orthodontist's life that have little or no consideration at the sectional or national meetings, yet are of much importance in preparing him mentally, psychologically, and physically to give his best in the management of his office and in the efficiency and welfare of his practice. We believe that it is a worth-while project to bring up various subjects for consideration in a frank and friendly manner, serving to coordinate our thinking on many personal and orthodontic problems and thereby fostering a better understanding of each other.

The character of our meetings is chiefly of the round-table workshop type. We have no formal papers, as a rule. A formal agenda covering a variety of subjects is studiously followed. Everyone present has an opportunity and is urged to express his views on each subject or problem. Our rather small membership permits us to collaborate freely and, of course, occasionally disagree, but agreeably. The interchange of views is regarded as quite helpful and instructive, and it can be humbly stated that no one has all the answers. In all, the atmosphere of the occasion remains quite stable. The spirit of the group is on a very high level. An obvious outgrowth of the first order is the development of a fine fellowship and personal relationship throughout the entire membership.

The meetings are held twice each year with a social hour and a dinner on a Sunday evening, followed by a round-table discussion of two to three hours. The program continues the following morning and adjourns in mid-afternoon. A short presentation by a leader (usually the president) is followed by a timed question-and-answer period, which at times develops many phases of a subject and a healthy exchange of opinions from which we all benefit. The programs have been inspiring and informative.

An interesting feature of our early meetings was the presentation of difficult and unusual cases, with possible treatment, and including failures as well. Case histories were passed around the council table so that each member could have an opportunity to express his views. This phase of our programs has been received with such favor that at each succeeding meeting problem cases and failures have a place for discussion and analysis. Naturally, many problems are of a controversial nature and bring out the process of one's thinking. In truth, these sessions are the melting pot, so to speak, for orthodontics in Oklahoma.

Some of our topics for discussion comprised the interrelation and responsibility of the orthodontist to the dentist, the pedodontist, the periodontist, the exodontist, the oral surgeon, the physician, the pediatrician, and fellow orthodontist. Of unusual interest was a special program featuring the collaboration of all the dental and medical specialists on the problems of the growing child.

The "Smile Contest," first sponsored by the members of the local dental society, was so popular in its public relation effect that it was adopted as one of the projects of the State Dental Association. This contest which is conducted in the schools by dental examinations consists of the selection of the boy and girl with the most perfect teeth. Competition is first in the schools, then the districts, and finally is state wide. The results of the contest were so successfully and favorably received that it will continue as an annual feature of the state dental program. The Oklahoma Orthodontic Group was privileged to have an active participation in the Smile Contest.

The discussion of the relationship of one orthodontist to another was an important topic. Many good points were brought out, covering the proper procedure of referring of patients, including the matter of records, plan of treatment, appliances, fees, ethics, etc., in the interest of the patient.

Realizing that the welfare of an orthodontist and his family, as well as a pleasant surrounding in one's office, is important in the operation of a successful practice, a wide study of the fields of economics was considered essential. For two years this study was featured at our meetings. Invited to appear before our group were experts in the fields of savings, investments, insurance, wills, trusts, estates, and taxes. A thoughtful study of these security matters will add to the happiness of one's family life and indirectly contribute to a more successful service to the patient.

During the 1955-56 sessions, the pedodontists and the members of the Society of Dentistry for Children were invited to collaborate with our group. We were grateful for their participation and highly enjoyed their discussions of interrelated points, all of which will be helpful in planning the needs of our patients.

The following agenda, suitably timed, was followed for the two 1955-56 sessions with some possible holdovers for future meetings:

(1) Case Presentations; (2) Ectopic Eruption; (3) Root Resorption, Deciduous-Permanent; (4) Supernumeraries; (5) Impactions; (6) Congenital Absence; (7) Space Maintenance; (8) Report of Committee on Dental Education-Dental Laws-Improvement of Method of Examination; (9) Report of Committee on Smile Contest.

Miscellaneous: (1) Preventive Orthodontics; (2) Problems of Transitional Stage of Development; (3) Time for Orthodontic Treatment; (4) Problems of Growth; (5) Endocrine Dyscrasias or Anatomical Dyscrasias; (6) Decalcification and Orthodontic Appliances.

Surgical Problems: (1) Surgical Problems, Cysts, etc.; (2) Impactions, Deciduous-Permanent; (3) Third Molars; (4) Supernumeraries; (5) Surgical Orthodontics; (6) Frenums, Maxillary-Mandibular; (7) Ectopic Eruption; (8) Ankylosed Teeth; (9) Serial Extractions; (10) Blocked-Out Teeth; (11) Crypt Extractions.

Oral Habits: (1) Thumb-Sucking; (2) Lip-Biting; (3) Fingernail-Biting; (4) Bobby Pins; (5) Tongue Thrusting; (6) Sleeping Habits; (7) Swallowing Habits; (8) Open-Bites—Causes and Cures; (9) Cross-Bites—Causes and Cures; (10) Facial Asymmetry; (11) Musculature; (12) Musical Instruments; (13) Mouth Breathing; (14) Posture Habits; (15) Labio-frenum.

Business: (1) Problems of Patient-Parent Education; (2) Public Relations; (3) Business Management; (4) Incidence of Malocclusion; (5) The Problem of Orthodontic Mechanics; (6) Failures.

The following guests and collaborators attended our 1955-56 meetings:

Pedodontists—Dean Robertson; Sumner A. Russman; Ben Caudle; and John Lewis; Douglas L. Rippeto, President, Oklahoma State Dental Association; William E. Cole, Secretary-Treasurer, Board of Governors of Registered Dentists; Howard Dukes, Kansas City, Missouri; William C. Hopkins, Secretary, Society of Dentistry for Children.

Periodontist—Douglas Yeager.

Oral Surgeon—Robert Hirschi.

Members who have served as presidents follow:

Earl R. Cunningham, Oklahoma City, 1950-51.
Earl R. Cunningham, Oklahoma City, 1951-52.
Hugh A. Sims, Tulsa, 1952-53.
Marion A. Flesher, Oklahoma City, 1953-54.
Harold S. Born, Bartlesville, 1954-55.
Harry H. Sorrels, Oklahoma City, 1955-56.

These meetings furnish the substance that comes very close to meeting the needs of the orthodontic practitioner, all of which enables us to fulfill our responsibilities to the public more successfully.

The closing remark of our retiring president and program leader, Harry H. Sorrels, defines the endeavor of the Oklahoma State Orthodontic Society: "To do a better job on all fronts."

W. E. F.

Angle School of Orthodontics, Class of 1903

In the July, 1956, issue of the AMERICAN JOURNAL OF ORTHODONTICS (volume 42, No. 7, page 557) appeared a photograph of the Angle School of Orthodontics, Class of 1903.

The fifth man in the middle row (reading from left to right) was said to be "Newcomb." This was an error. The man has been identified as Dr. Ray D. Robinson, pioneer orthodontist of Los Angeles, California.

European Essayists

Oren A. Oliver, D.D.S., L.L.D., of Nashville, Tennessee, and Hal Terry, B.S., D.M.D., of Miami, Florida, presented a paper in Bonn, Germany, on the subject of "Labiolingo Appliance Technique Including the Guide Plane."*

This presentation was followed by an exhibit of a number of case reports revealing cases before and subsequent to treatment. The date of presentation was June, 1954.

The group before which Drs. Oliver and Terry appeared was Bonn University. This summer several other American orthodontists, including Drs. B. F. Dewel of Evanston, Illinois, Leo M. Shanley of St. Louis, Missouri, and John Richmond of Kansas City, Kansas, will appear on European programs.

Research Grants

The Public Health Service, National Institutes of Health, have awarded a research grant to the Orthodontic Department of the Dental Department of the University of Michigan, entitled "Serial Analysis of Some Phases of Dental and Occlusal Development." The funds will be utilized to prepare for reports on a series of studies making use of the growth data in the University of Michigan Elementary School growth study. The fund will provide for a full-time researchist, technical and secretarial staff, as well as some instrumentation.

In addition to the above, the Army Office of the Surgeon General has awarded a research grant. It bears the title of "An Electromyographic Study of the Oral and Facial Musculature." This will be a continuation of previous research upon this subject started at the University of Iowa and continued at the University of Toronto by Dr. Robert E. Moyers, head of the department.

The New Zealand Orthodontic Society**

The increasing interest in orthodontic problems was reflected by a large attendance at the Annual Meeting. With the ample time allowed by the conveners of the Annual Conference of the N.Z.D.A. the Society was able to present a full programme to members. The theme was "Diagnosis in Orthodontics," the first paper on this topic being read by the President, Dr. A. H. Gresham. He dealt with the need for a systematic approach to the problem and enumerated the important factors which affect the diagnosis and treatment of malocclusion. Mr. J. F. A. Harding presented a series of slides of various malocclusions, and discussed the difficulties of diagnosis and treatment in each. In the discussion that followed it was stressed that the operator's ability to construct and use certain types of appliances limited diagnostic possibilities. The passing of the "expansion era" was noted and also disappointments in the treatment of Angle Class II malocclusions with the Andresen appliance. Greater discrimination in the selection of patients would reduce the latter.

It was felt that the Diagnostic Service provided by the Society could be used by more dentists. Even within the limitations of a postal service, considerable assistance can often be given. Models, with a case history and any necessary radiographs, should be sent to the President or Secretary.

At the Society's formal meeting, Dr. A. H. Gresham was re-elected as President, Dr. R. C. Tonkin as Vice-President, and Mr. J. F. A. Harding as Secretary.

*Published in Die okklusale Fuhrungsebene Bond (16), 1955, Heft 4.
**From the *Journal of the New Zealand Dental Association.*

Army Dental Corps Training Programs Reach New High

Dental education in the Army reached the highest participation mark in the history of the Dental Corps during the year ending June 30, 1956, and begins the new fiscal year with the admission of a dental officer into the Army War College, Carlisle, Pennsylvania, for the first time.

While the selection of a dental officer for War College attendance is regarded as a signal honor for both the Corps and the officer, this step is the normal and proper capstone of the Army dental education program, according to Corps officials. The Corps has had representation at the Command and General Staff College, Fort Leavenworth, Kansas, for several years and had sixteen officers to be graduated in 1955-56 from the advanced and associate courses at the Army Medical Service School, Fort Sam Houston, Texas. This has resulted in all deputy Army and theater dental surgeons having had the advanced officer course and a majority of the post dental surgeons having had a refresher course in command and staff procedures. The War College curriculum has for its objective a study of the problems and duties of general staff officers of the Army.

In addition to the foregoing military training, the dental officers have attended courses in the management of mass casualties given at Walter Reed Army Institute of Research and the medical care of atomic casualties at Brooke Army Medical Center.

The comprehensive professional training for the dental graduate commissioned and on active duty begins with the twenty-four internships in various Army hospitals, applications for which were received for 1956-57 in larger numbers than in previous years. Seven residents completed a two-year training period in June, 1956, and three more began participation in the program. Prosthodontics and oral surgery were the two specialties between which they were divided. In-service short courses were conducted at Walter Reed Army Hospital, Letterman Army Hospital, and the Armed Forces Institute of Pathology, 155 officers completing the courses. The course in oral diagnosis and treatment planning, given for the first time this year at the Institute, attracted thirty-one students.

A total of thirteen officers attended courses at civilian universities or dental schools for longer periods in eight different specialized fields of dentistry. An equal number enrolled in civilian institutions for short courses in six various categories of training, including procedures for conducting workshops for dental laboratory technicians.

Thus, the over-all educational activities of the Corps have both military and professional opportunities for the officer's growth and usefulness to the Army.

Army Medical Service Acquires More American Board Diplomates

Internal medicine is the most popular medical specialty in the Army, with surgery as a close second, according to the results of the most recent semiannual survey announced today by Colonel Joseph H. McNinch, Chief of the Personnel Division in the Office of the Surgeon General.

Seventeen per cent of the 681 medical officers, both Regular Army and Reserve, holding specialty certification are diplomates in internal medicine. About 15 per cent are in the surgical group. The remaining 68 per cent are distributed among twenty-three specialties and subspecialties.

Each June and December, the Office of the Surgeon General reviews the number of medical, dental, veterinary, and allied science officers on active duty who have attained certification by one of the American medical specialty boards. June, 1956, figures show 741 board diplomates in the Army Medical Service in nearly forty different specialties, including clinical chemistry, clinical or industrial or personnel psychology, nutrition, and x-ray and radium physics certification held by Medical Service Corps officers.

While this 1956 total was exceeded slightly in the Korean fighting period when large numbers of reserve officers were recalled to active duty, it reflects the constant growth of American board diplomate census in the Army Medical Service since its graduate professional training program was instituted in 1947.

At the time this program was inaugurated, the Army had only eighty-three specialists plus forty-four non-Regulars certified by the American boards, making a total of 127 diplomates. By February of 1949, the number had grown to 143 Regular officers and ten civilian component (Reserve and National Guard) officers on active duty. In March, 1951, the Service had 354 officers who had been certified and two years later, under the stimulus of the need in Korea, there were more than 800 diplomates in the Medical Corps alone.

Since the beginning of the graduate professional training, the number of medical careerists (Regular Army) with specialty diplomas has always been larger than the non-Regulars. Certification by a specialty board is one of the objectives of the educational activities conducted in the Army's teaching hospitals and the annual results of the difficult board examinations, Army-wise, have been a constant source of gratification to the officials responsible for the graduate program.

There has been also a steady, small accumulation annually of diplomates who have prepared themselves and taken equally exacting tests for certification in a subspecialty in their fields. For instance, six of the internal medicine diplomates hold board certification in cardiovascular diseases; five hold board diplomas in pulmonary diseases as a subspecialty to their internal medicine certification.

The second largest group of diplomates in the Army Medical Service is in the Dental Corps, which accounted for forty-three officers, both RA and Reserve, in the June, 1956, survey, one of whom has also been certified in a subspecialty. Prosthodontics accounts for almost half of these diplomates, with oral surgery as second choice. As with the Medical Corps, the dental residency program is considered to be a factor, especially among the younger diplomates, in the growing number of board-certified Army dental officers.

The Medical Service Corps has nine American board diplomates, clinical chemistry and clinical psychology being equally favored. Many of the Medical Service Corps officers have achieved their Ph.D. degrees and possess qualifying experience certified by their respective national associations in fields where American specialty boards do not conduct examinations.

The Veterinary Corps concludes the June, 1956, summary with eight diplomates, equally divided between veterinary public health and veterinary pathology.

Postgraduate Courses at Temple University School of Dentistry

The following postgraduate courses will be presented during the 1956-57 session:

Course 1. Periodontics. Jacoby Rothner and associates. November 5 to 17, inclusive.

Course 2. Full Denture Prosthesis. Bernard Jankelson. November 26 to 30, inclusive.

Course 3. Occlusion and What To Do About It. Bernard Jankelson. December 3 to 6, inclusive.

Course 4. Advanced Orthodontics. Robert H. W. Strang. January 20 to February 2, inclusive.

Course 5. Practice Administration. Jay H. Eshleman. January 30 to February 1, inclusive.

Course 6. Periodontal Prosthesis. Morton Amsterdam and Walter Cohen. February 11 to 16, inclusive.

Course 7. Orthodontics in Periodontal Therapy. Jack Alloy and Maxwell Fogelman. April 11 to 13, inclusive.

For additional information and application, write to Dr. Louis Herman, Postgraduate Division, Temple University School of Dentistry, 3223 North Broad St., Philadelphia 40, Pennsylvania.

St. Louis University

Under the direction of S. Lewis, D.D.S., Director, and F. C. Shelden, D.D.S., Co-director, and associated instructors, St. Louis University School of Dentistry, Orthodontic Department, held a postgraduate course in the edgewise technique, July 8 through July 21, 1956.

Fifty-seven students were enrolled for the course.

Notes of Interest

R. D. Boice, D.D.S., announces the opening of his offices for the exclusive practice of orthodontics at The Dental Building, 330 Maine, Lawrence, Kansas.

Dr. Joseph E. Johnson announces that John E. Johnson, D.D.S., is now associated with him in the practice of orthodontics, 752 Starks Bldg., Louisville, Kentucky.

C. R. Geier, D.D.S., announces the removal of his office to 4307 South Grand Blvd., St. Louis, Missouri, practice limited to orthodontics.

George Newman, A.B., D.M.D., announces the opening of his office at The Barclay Plaza Bldg., 110-20 71st Rd., Forest Hills, Queens, New York, practice limited to orthodontics.

Leonard O. Oden, D.D.S., announces the opening of his offices at 708-711 Medical Arts Bldg., Norfolk, Virginia, and 2612 Kecoughtan Rd., Hampton, Virginia, practice limited to orthodontics.

D. D. Swanbom, D.D.S., announces the opening of his office at 132 South College Ave., Fort Collins, Colorado, practice limited to orthodontics.

Sidney G. Zagoreen, D.D.S., announces that this practice is now limited to orthodontics, 280 Hobart St., Perth Amboy, New Jersey.

Correction: Dr. Andrew F. Jackson of Philadelphia, Pennsylvania, announces that, due to zoning regulations in Montgomery County, Pennsylvania, he will continue his practice in the Medical Arts Building, Suite 1401-02, Philadelphia, as in the past. He will have associated with him Dr. Henry O'Hern, Jr., who at present is an instructor in orthodontics at the University of Pennsylvania.

OFFICERS OF ORTHODONTIC SOCIETIES

THE AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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President, A. C. Broussard - - - - - - - - - Maison Blanche Bldg., New Orleans, La.
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President, Richard A. Smith - - - - - - - - - - 9401 Ridgeway Ave., Evanston, Ill.
Secretary-Treasurer, William F. Ford - - - - - - - 575 Lincoln Ave., Winnetka, Ill.

Great Lakes Society of Orthodontists

President, Milton R. Culbert - - - - - - - 73 Warren Rd., Toronto, Ontario, Canada.
Treasurer, Russell E. Huber - - - - - - - - 350 Fidelity Bank Bldg., Dayton, Ohio.
Secretary, H. I. Miller - - - - - - - - - - 1416 Mott Foundation Bldg., Flint, Mich.

Middle Atlantic Society of Orthodontists

President, Daniel E. Shehan - - - - - - - - - - - Medical Arts Bldg., Baltimore, Md.
Secretary-Treasurer, Paul Deems - - - - - - - - - - 835 Park Ave., Baltimore, Md.

Northeastern Society of Orthodontists

President, Oscar Jacobson - - - - - - - - - - - - 35 W. 81st St., New York, N. Y.
Secretary-Treasurer, Wilbur J. Prezzano - - - - Medical Centre, White Plains, N. Y.

Pacific Coast Society of Orthodontists

President, Arnold E. Stoller - - - - - - - - - - Medical Dental Bldg., Seattle, Wash.
Secretary-Treasurer, Raymond M. Curtner - - - - 450 Sutter St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, Richard Harshman - - - - - - - - - - 2402 Broadway, Scotts Bluff, Neb.
Secretary-Treasurer, Howard L. Wilson - - - - - - - Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, William Jarrett - - - Kanawha Banking and Trust Bldg., Charleston, W. Va.
Secretary-Treasurer, H. K. Terry - - - - - - - - - 2742 Biscayne Blvd., Miami, Fla.

Southwestern Society of Orthodontists

President, Ott L. Voigt - - - - - - - - - - - - - - 4115 Fannin, Houston, Texas.
Secretary-Treasurer, Harold S. Born - - - - - - - 908 S. Johnstone, Bartlesville, Okla.

American Board of Orthodontics

President, Ernest L. Johnson - - - - - - - - 450 Sutter St., San Francisco, Calif.
Vice-President, Lowrie J. Porter - - - - - - - 41 East 57th St., New York, N. Y.
Secretary, Wendell L. Wylie - - - - - - University of California School of Dentistry, The Medical Center, San Francisco, Calif.
Treasurer, Jacob A. Salzmann - - - - - - - - 654 Madison Ave., New York, N. Y.
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Director, L. Bodine Higley - - - - University of North Carolina, Chapel Hill, N. C.
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St. Louis 3, U. S. A.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

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Official Publication of The American Association of Orthodontists, its component societies and The American Board of Orthodontics

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